VOL. 6 NO. 15
August 15, 1981

# Energy Research Abstracts

ABSTRACTS 21487-22990

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

# CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications which are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the energy data base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below.

## PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

***Energy Abstracts for Policy Analysis (EAPA)***

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $4.00, foreign $5.00 per copy; annual cumulative index, domestic $6.00, foreign $7.50 per copy. The annual subscription price is $44.00 for domestic subscribers and $55.00 for foreign subscribers.

***Energy Research Abstracts (ERA)***

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. Indexes are cumulated semiannually and annually. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues including a semiannual index and an annual index is $184.00 for domestic subscribers and $230.00 for foreign subscribers. The semiannual and annual indexes will also be available separately to subscribers. The cost for the semiannual index is $18.00 (domestic) or $22.50 (foreign); the annual index is $33.00 (domestic) or $41.25 (foreign). A single issue costs $5.55 (domestic) or $6.95 (foreign).

The following publications are available to the public on a subscription basis from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $45.00 for domestic subscribers and $90.00 for subscribers outside the North American Continent. A single issue is $6.00 (domestic) and $12.00 (outside the North American Continent).

***Current Energy Patents (CEP)***

A monthly publication providing abstracting and indexing coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization. Available as PB81-902800.

***Energy Conservation Update (ECU)***

A monthly abstract journal devoted to current information on energy conservation in buildings, transportation and propulsion, and industry; waste processing plants and equipment; energy storage; energy conversion; advanced automotive systems; combustion systems; power cycles; synthetic fuels; and power transmission. Available as PB81-914800.

***Energy and the Environment (EAE)***

A monthly abstract journal devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment. Available as PB81-914900.

***Fossil Energy Update (FEU)***

A monthly abstract journal devoted to information on the processing and use of fossil fuels. Available as PB81-914600.

***Fusion Energy Update (CFU)***

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB81-915300.

***Geothermal Energy Update (GEU)***

A monthly abstract journal devoted to information on the exploration and development of geothermal resources. Available as PB81-914700.

***Solar Energy Update (SEU)***

A monthly abstract journal devoted to information on the utilization of solar, tidal, and wind energy. Available as PB81-914500.

***Synthetic Fuels Update (SFU)***

A monthly abstract journal devoted to information on coal gasification; coal liquefaction; other coal processing; biomass conversion to fuel; shale oil and tar sand bitumen production; hydrogen fuels; other hydrocarbon fuels; alcohol fuels; and inorganic hydrogen compound fuels. Available as PB81-902700.

## INTERNATIONAL ENERGY PUBLICATIONS

***Atomindex*** (Published in cooperation with the Technical Information Center by the International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria)

A semimonthly abstract journal devoted to information on nuclear science and technology. Through an exchange agreement, IAEA/INIS provides all non-U. S. nuclear information of *Atomindex* to TIC for inclusion in the DOE/RECON Data Base; in turn, TIC provides all U. S. nuclear information to IAEA/INIS for inclusion in *Atomindex*. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

***Coal Abstracts*** (Published in cooperation with the Technical Information Center by the International Energy Agency, IEA Coal Research, London, England)

A monthly abstract journal devoted to information on coal. Through an exchange agreement, IEA Coal Research provides all non-U. S. coal information of *Coal Abstracts* to TIC for inclusion in the DOE/RECON Data Base; in turn, TIC provides all U. S. coal information to IEA Coal Research for inclusion in *Coal Abstracts*. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

International Copyright, © U. S. Department of Energy, 1979, under the provisions of the Universal Copyright Convention.
United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

energinfo ERA

Vol. 6, No. 15
ISSN: 0160-3604
CODEN: ERABD
August 15, 1981

# ENERGY RESEARCH ABSTRACTS

**ABOUT THE TECHNICAL INFORMATION CENTER**

The Technical Information Center, as the national information center for the Department of Energy, manages, publishes, and disseminates scientific, technical, and practical energy information acquired from worldwide sources. It builds and maintains energy information data bases used to prepare abstracting journals, bibliographies, and literature searches. The data bases are also searchable via the Department's on-line retrieval system, DOE/RECON. This information is provided to DOE program offices and contractors; scientists; engineers; educational, commercial, and industrial communities; and the general public. The Technical Information Center conducts an active announcement and marketing program. It establishes policy and administers control of an inventory and registry for DOE publications. The Center also develops and evaluates new and effective information systems and services as required by scientific and technical management within the Department of Energy.

**UNITED STATES DEPARTMENT OF ENERGY**

**James B. Edwards**

Secretary

---

**Joseph G. Coyne**

Manager
Technical Information Center

---

## ABOUT *ENERGY RESEARCH ABSTRACTS*

*Energy Research Abstracts (ERA)* provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

*ERA* is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, conservation, safety, environmental impacts, and regulation.

*ERA* is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Federal, state, and municipal agencies concerned with energy development, conservation, and usage may obtain *ERA* free of charge. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

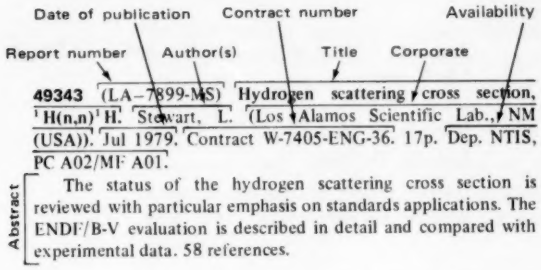
*ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues including a semiannual index and an annual index is $184.00 for domestic subscribers and $230.00 for foreign subscribers. The semiannual and annual indexes are also available separately to subscribers. The cost for the semiannual index is $18.00 (domestic) or $22.50 (foreign); the annual index is $33.00 (domestic) or $41.25 (foreign). A single issue costs $5.55 (domestic) or $6.95 (foreign).

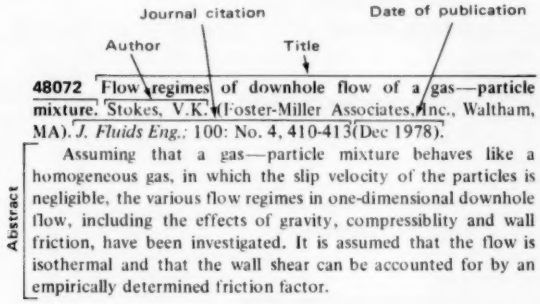
Published by the **United States Department of Energy, Technical Information Center**
**P. O. Box 62, Oak Ridge, Tennessee 37830**

# HOW TO USE *ENERGY RESEARCH ABSTRACTS*

## •ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Date of publication
Contract number
Availability
Report number
Author(s)
Title
Corporate
49343 (LA–7899-MS) Hydrogen scattering cross section, $^1H(n,n)^1H$. Stewart, L. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.
Abstract
The status of the hydrogen scattering cross section is reviewed with particular emphasis on standards applications. The ENDF/B-V evaluation is described in detail and compared with experimental data. 58 references.


Journal citation
Date of publication
Author
Title
48072 Flow regimes of downhole flow of a gas—particle mixture. Stokes, V.K. (Foster-Miller Associates, Inc., Waltham, MA). J. Fluids Eng.: 100: No. 4, 410-413 (Dec 1978).
Abstract
Assuming that a gas—particle mixture behaves like a homogeneous gas, in which the slip velocity of the particles is negligible, the various flow regimes in one-dimensional downhole flow, including the effects of gravity, compressiblity and wall friction, have been investigated. It is assumed that the flow is isothermal and that the wall shear can be accounted for by an empirically determined friction factor.

## •INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. These indexes are cumulated semiannually and annually. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

## •Corporate Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

49343 (LA–7899-MS) Hydrogen scattering cross section, $^1H(n,n)^1H$. Stewart, L. **(Los Alamos Scientific Lab., NM (USA))**. Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.

is indexed as:

**Los Alamos Scientific Lab., NM (USA)**
Advanced laser fusion target fabrication research and development proposal, 4:48249 (LA–7619-P)
Hydrogen scattering cross section, $^1H(n,n)^1H$, 4:49343 (LA–7899-MS)

## •Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

**Stewart, L.**, Hydrogen scattering cross section, $^1H(n,n)^1H$, 4:49343 (LA–7899-MS)
**Stewart, M.D.**, *See* McInroy, J.F., 4:49280
**Stewart, W.**, *See* Dean, J.W., 4:48543
**Stimson, J.**, Reproduction, growth, and survival of Enewetak corals, 4:49200 (NVO–0703-1, pp 56-59)

## •Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles and informative phrases, or both, specific to these entries are arranged alphabetically under the entries.

**HYDROGEN I TARGET**
**Neutron Reactions**
Hydrogen scattering cross section, $^1H(n,n)^1H$ (Above 100 keV, review), 4:49343 (LA–7899-MS)
**HYDROGEN NITRATES**
*See NITRIC ACID*
**HYDROLOGY**
**Research Programs**
Inventory of advanced energy technologies and energy conservation research and development: 1976-1978. Volume II. Prepared for the Committee on Science and Technology, U.S. House of Representatives, 96*th* Congress, 4:48749.

## •Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

| | | |
|---|---|---|
| **W-7405-ENG-36** | **Los Alamos Scientific Lab., NM (USA)** | |
| | 3:49698 | LA-tr–78-45 |
| | 3:49857 | LA–7224T |
| | 3:49863 | LA–7235-MS |
| **W-7405-ENG-48** | **California Univ., Livermore (USA). Lawrence Livermore Lab.** | |
| | 3:49386 | UCRL–52456 |
| | 3:49431 | UCRL–52405 |

## •Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience.

| | | |
|---|---|---|
| **LA-7899-MS** | 4:49343 | Dep. NTIS, PC A02/MF A01 |
| **LA-tr-78-69** | 4:48158 | Dep. NTIS, PC A03/MF A01 |

# STAFF OF ENERGY RESEARCH ABSTRACTS

**Editor**
David E. Bost

**Assistant Editors**
Lee M. Thompson
Charles E. Stuber

**Associate Editors for Fossil Energy**
M. Catherine Grissom
D. Lamar Cason
Dorothy M. Chertok
Lynda H. Kern
Betty L. McDowell
Lorne T. Newman
Donna G. Powers
Amy T. Tamura

**Associate Editors for Physical Sciences and Engineering**
Robert C. Kelly
Jack Blanshei
Donato DiGregorio
Lisbeth C. Lieberman
W. Hugh Kinser
George H. Thoeming

**Associate Editors for Environment and Life Sciences**
Sidney F. Lanier
E. Ray Bedford
Polly S. Blackburn
Jane G. Buchanan
Robert J. Chertok
Kathleen R. Meyer
Axel C. Ringe
David L. Snow

**Associate Editors for Nuclear Energy**
Henry D. Raleigh
David C. Cunningham
James R. Dulaney
Lawrence T. Whitehead
Milton O. Whitson

**Associate Editors for Conservation and Solar Energy**
Lila B. Smith
Dona C. Keller
Mona H. Raridon
Jerry M. Thomas
Martha C. Wilson
Larry E. Williams

**Report Evaluator**
John H. Mitchell

**Subject Heading Specialist**
Julia S. Redford

**Corporate Author Specialist**
Patsy L. Hendricks

**Report Number Specialist**
Wanda Parks

**Contract Number Specialist**
William D. Matheny

**Cataloging and Digitizing Coordinator**
J. Paul Meredith

**Computer Processing Coordinator**
Billy H. Brady

**Publishing Coordinator**
Irene D. Keller

International Copyright, © U. S. Department of Energy, 1979, under the provisions of the Universal Copyright Convention. United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts*, Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

# SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts.* The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.


**01 COAL AND COAL PRODUCTS**
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Regulations

**02 PETROLEUM**
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

**03 NATURAL GAS**
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Effects
- 09 Artificial Stimulation, Plowshare, etc.
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

**04 OIL SHALES AND TAR SANDS**
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

**05 NUCLEAR FUELS**
- 01 Reserves
- 02 Exploration
- 03 Mining
- 04 Feed Processing
- 05 Enrichment
- 06 By-Products
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing and Economics
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Regulations

**06 FUSION FUELS**
- 01 Sources
- 02 Processing
- 03 By-Products
- 04 Transport and Storage
- 05 Health and Safety
- 06 Regulations and Policy
- 07 Waste Management
- 08 Properties
- 09 Environmental Aspects

**07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY**
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies

**08 HYDROGEN**
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

**09 OTHER SYNTHETIC AND NATURAL FUELS**
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

**13 HYDRO ENERGY**
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power Conversion Systems

**14 SOLAR ENERGY**
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Plants
- 07 Solar Thermal Power Plants
- 08 Ocean Thermal Gradient Power Plants
- 09 Solar Radiation Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

**15 GEOTHERMAL ENERGY**
- 01 Resource Status and Assessment
- 02 Geology, Hydrology, and Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

**15 GEOTHERMAL ENERGY (CONT.)**
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

**16 TIDAL POWER**
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 07 Tidal Power Plants
- 08 Wave Energy Converters

**17 WIND ENERGY**
- 01 Availability (Climatology)
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 06 Wind Energy Engineering

**20 ELECTRIC POWER ENGINEERING**
- 01 Power Plants and Power Generation
- 02 Environmental Aspects
- 03 Power Transmission and Distribution

**21 NUCLEAR POWER PLANTS**
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 05 Power Reactors, Breeding
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 07 Regulation and Licensing
- 08 Economics
- 09 Process Heat Reactors

**22 NUCLEAR REACTOR TECHNOLOGY**
- 01 Theory and Calculation
- 02 Components and Accessories
- 03 Fuel Elements
- 04 Control Systems
- 05 Environmental Aspects
- 06 Research, Test, and Experimental Reactors
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety

**25 ENERGY STORAGE**
- 01 Magnetic
- 02 Compressed Gas
- 03 Pumped Hydro
- 04 Capacitor Banks
- 05 Flywheels
- 06 Thermal
- 07 Liquefied Gas
- 08 Chemical
- 09 Batteries

**29 ENERGY PLANNING AND POLICY**
- 01 Energy Analysis and Modeling
- 02 Economics and Sociology
- 03 Environment, Health, and Safety
- 04 Natural Resources
- 05 Research, Development, Demonstration, and Commercialization
- 06 Nuclear Energy
- 07 Transport and Storage
- 08 Waste Heat Utilization
- 10 Conservation
- 20 Supply, Demand, and Forecasting
- 30 Policy, Legislation, and Regulation
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 60 Electric Power
- 80 Consumption and Utilization
- 90 Unconventional Sources and Power Generation

**30 ENERGY CONVERSION**
- 01 MHD Generators
- 02 EHD Generators
- 03 Thermoelectric Generators
- 04 Thermionic Converters
- 05 Fuel Cells
- 08 Electromechanical Converters

**32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION**
- 01 Buildings
- 02 Transportation
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 09 Education and Public Relations

**33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS**
- 01 Internal Combustion Engines
- 02 External Combustion Engines
- 03 Electric-Powered Systems
- 04 Hybrid Systems
- 05 Flywheel Propulsion
- 06 Vehicle Design Factors
- 07 Emission Control
- 08 Alternative Fuels

**36 MATERIALS**
- 01 Metals and Alloys
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 04 Polymers and Plastics
- 06 Other Materials

**40 CHEMISTRY**
- 01 Analytical and Separations Chemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 04 Electrochemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry
- 08 Combustion Chemistry

**42 ENGINEERING**
- 01 General Engineering
- 02 Facilities and Equipment
- 03 Lasers
- 04 Heat Transfer and Fluid Flow
- 05 Materials Testing

**42 ENGINEERING (CONT.)**
- 06 Safety Engineering
- 07 Vacuum Engineering
- 08 Electronic Circuits and Devices
- 09 Waste Processing Plants and Equipment
- 10 Combustion Systems
- 20 Underground Engineering
- 30 Marine Engineering
- 40 Pollution Control Equipment
- 50 Power Cycles

**43 PARTICLE ACCELERATORS**
- 01 Design, Development, and Operation
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 03 Auxiliaries and Components
- 04 Storage Rings

**44 INSTRUMENTATION**
- 01 Radiation Instrumentation
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 03 Miscellaneous Instruments
- 04 Well Logging Instrumentation

**45 EXPLOSIONS AND EXPLOSIVES**
- 01 Chemical
- 02 Nuclear
- 03 Explosion Detection

**50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**51 ENVIRONMENTAL SCIENCES, TERRESTRIAL**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**52 ENVIRONMENTAL SCIENCES, AQUATIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

**53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES**
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements

**55 BIOMEDICAL SCIENCES, BASIC STUDIES**
01 Behavioral Biology
02 Biochemistry
03 Cytology
04 Genetics
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

**56 BIOMEDICAL SCIENCES, APPLIED STUDIES**
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicity
04 Other Environmental Pollutant Effects

**57 HEALTH AND SAFETY**

**58 GEOSCIENCES**
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

**64 PHYSICS RESEARCH**
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

**65 PHYSICS RESEARCH (CONT.)**
10 Nuclear Physics
40 Radiation and Shielding Physics
50 Medical Physics
60 Solid State Physics
70 Theoretical Physics
80 Mathematical Physics

**65 PHYSICS RESEARCH (CONT.)**
90 Communication, Education, History, and Philosophy

**70 FUSION ENERGY**
01 Plasma Research
02 Fusion Power Plant Technology

**99 GENERAL AND MISCELLANEOUS**
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

**CORPORATE INDEX**

**AUTHOR INDEX**

**SUBJECT INDEX**

**CONTRACT NUMBER INDEX**

**REPORT NUMBER INDEX**

# SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.


**33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS**
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

**56 BIOMEDICAL SCIENCES, APPLIED STUDIES**
- 03 Chemicals Metabolism and Toxicity
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

**55 BIOMEDICAL SCIENCES, BASIC STUDIES**
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

**40 CHEMISTRY**
- 01 Analytical and Separations Chemistry
- 08 Combustion Chemistry
- 04 Electrochemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

**01 COAL AND COAL PRODUCTS**
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 50 Marketing and Economics
- 20 Mining
- 04 Processing
- 06 Properties
- 70 Regulations
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

**20 ELECTRIC POWER ENGINEERING**
- 02 Environmental Aspects
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

**32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION**
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

**30 ENERGY CONVERSION**
- 02 EHD Generators
- 08 Electromechanical Converters
- 05 Fuel Cells
- 01 MHD Generators
- 04 Thermionic Converters
- 03 Thermoelectric Generators

**29 ENERGY PLANNING AND POLICY**
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

**25 ENERGY STORAGE**
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

**42 ENGINEERING**
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 01 General Engineering
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 06 Safety Engineering
- 20 Underground Engineering
- 07 Vacuum Engineering
- 09 Waste Processing Plants and Equipment

**52 ENVIRONMENTAL SCIENCES, AQUATIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**51 ENVIRONMENTAL SCIENCES, TERRESTRIAL**
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

**53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES**
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements
- 01 Social and Economic Studies

**45 EXPLOSIONS AND EXPLOSIVES**
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

**70 FUSION ENERGY**
- 02 Fusion Power Plant Technology
- 01 Plasma Research

**06 FUSION FUELS**
- 03 By-Products
- 09 Environmental Aspects
- 05 Health and Safety
- 02 Processing
- 08 Properties
- 06 Regulations and Policy
- 01 Sources
- 04 Transport and Storage
- 07 Waste Management

**99 GENERAL AND MISCELLANEOUS**
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

**58 GEOSCIENCES**
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

**15 GEOTHERMAL ENERGY**
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology, Hydrology, and Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

**57 HEALTH AND SAFETY**

**13 HYDRO ENERGY**
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

**08 HYDROGEN**
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

**44 INSTRUMENTATION**
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

**07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY**
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

**36 MATERIALS**
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 01 Metals and Alloys
- 06 Other Materials
- 04 Polymers and Plastics

**03 NATURAL GAS**
- 09 Artificial Stimulation, Plowshare, etc.
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Effects
- 02 Geology and Exploration
- 05 Health and Safety
- 06 Marketing and Economics
- 10 Policy, Legislation, and Regulation
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

**05 NUCLEAR FUELS**
- 06 By-Products
- 05 Enrichment
- 30 Environmental Aspects
- 02 Exploration
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 10 Marketing and Economics
- 03 Mining
- 50 Regulations
- 01 Reserves
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 20 Waste Management

**21 NUCLEAR POWER PLANTS**
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 09 Process Heat Reactors
- 07 Regulation and Licensing

**22 NUCLEAR REACTOR TECHNOLOGY**
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

**04 OIL SHALES AND TAR SANDS**
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

**09 OTHER SYNTHETIC AND NATURAL FUELS**
02 Alcohol Fuels
06 Gaseous Waste Fuels
01 Hydrocarbon Fuels
03 Inorganic Hydrogen Compound Fuels
05 Liquid Waste Fuels
04 Solid Waste Fuels

**43 PARTICLE ACCELERATORS**
03 Auxiliaries and Components
02 Beam Dynamics, Field Calculations, and Ion Optics
01 Design, Development, and Operation
04 Storage Rings

**02 PETROLEUM**
50 Combustion
03 Drilling and Production
09 Environmental Aspects
02 Geology and Exploration
06 Health and Safety
07 Marketing and Economics
10 Policy, Legislation, and Regulation
04 Processing
05 Products and By-Products
30 Properties
01 Reserves
40 Storage
20 Transport, Pipelines, and Handling
08 Waste Management

**64 PHYSICS RESEARCH**
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

**65 PHYSICS RESEARCH (CONT.)**
90 Communication, Education, History, and Philosophy
80 Mathematical Physics
50 Medical Physics
10 Nuclear Physics
40 Radiation and Shielding Physics
60 Solid State Physics
70 Theoretical Physics

**14 SOLAR ENERGY**
03 Economics
04 Environmental, Legal, and Institutional Aspects
20 Heat Storage
08 Ocean Thermal Gradient Power Plants
06 Photovoltaic Power Plants
01 Resources and Availability
10 Solar Collectors and Concentrators
05 Solar Energy Conversion
09 Solar Radiation Utilization
07 Solar Thermal Power Plants

**16 TIDAL POWER**
04 Economics
05 Environmental Aspects
03 Regulations
07 Tidal Power Plants
08 Wave Energy Converters

**17 WIND ENERGY**
01 Availability (Climatology)
04 Economics
05 Environmental Aspects
03 Regulations
06 Wind Energy Engineering

**CORPORATE INDEX**

**AUTHOR INDEX**

**SUBJECT INDEX**

**CONTRACT NUMBER INDEX**

**REPORT NUMBER INDEX**

# ENERGY RESEARCH ABSTRACTS

## 01 COAL AND COAL PRODUCTS

**21487 (DOE/FC/10066—T1-(Vol.3)) Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation.** (Energy Resources Co., Inc., Walnut Creek, CA (USA)). Nov 1980. Contract AC18-79FC10066. 833p. NTIS, PC A99/MF A01.

Technologies applicable to the development and use of low-rank coals are analyzed in order to identify specific needs for research, development, and demonstration (RD and D). Major sections of the report address the following technologies: extraction; transportation; preparation, handling and storage; conventional combustion and environmental control technology; gasification; liquefaction; and pyrolysis. Each of these sections contains an introduction and summary of the key issues with regard to subbituminous coal and lignite; description of all relevant technology, both existing and under development; a description of related environmental control technology; an evaluation of the effects of low-rank coal properties on the technology; and summaries of current commercial status of the technology and/or current RD and D projects relevant to low-rank coals.

**21488 (DOE/FC/10066—T1(Vol.5)) Low-rank coal study. Volume 5. RD and D program evaluation.** (Energy Resources Co., Inc., Walnut Creek, CA (USA)). Nov 1980. Contract AC18-79FC10066. 133p. NTIS, PC A07/MF A01.

A national program is recommended for research, development, and demonstration (RD and D) of improved technologies for the enviromentally acceptable use of low-rank coals. RD and D project recommendations are outlined in all applicable technology areas, including extraction, transportation, preparation, handling and storage, conventional combustion and environmental control technology, fluidized bed combustion, gasification, liquefaction, and pyrolysis. Basic research topics are identified separately, as well as a series of crosscutting research activities addressing environmental, economic, and regulatory issues. The recommended RD and D activities are classified into Priority I and Priority II categories, reflecting their relative urgency and potential impact on the advancement of low-rank coal development. Summaries of ongoing research projects on low-rank coals in the US are presented in an Appendix, and the relationships of these ongoing efforts to the recommended RD and D program are discussed.

### 0104 Processing

*REFER ALSO TO CITATION(S) 21538, 21733, 22049, 22329, 22459*

**21489 (CONF-810417—6) Overview of coal-gasification-materials experience in selected pilot plants.** Arnold, J.M.; Laurens, R.M.; Danyluk, S. (Institute of Gas Technology, Chicago, IL (USA); Illinois Univ., Chicago (USA)). 1981. 30p. NTIS, PC A03/MF A01.

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

Two coal gasification pilot plants operated by the Institute of Gas Technology, the HYGAS pilot plant and the U-GAS pilot plant, have participated in materials evaluation programs sponsored by the US Departmentof Energy and the Gas Research Institute. Looking at these and other results, metals performance is seen to depend on the nature of the process involved: under relatively benign conditions, exotic alloys, clads, or coatings may not be needed; high-temperature environments may limit the use of internal piping and valving in scale-up designs. Lower-chromium, nickel-base alloys performed erratically in tests conducted so far.

**21490 (CONF-810473—1) Mathematical modeling and control of the coke making process.** Tang, A.; Leininger, G.; Eckert, R. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). Apr 1981. Contract AS07-80CS40361. 22p. NTIS, PC A02/MF A01.

From 13. symposium and research progress review meeting for present and potential sponsors; West Lafayette, IN, USA (23 Apr 1981).

A brief review of the NKK coke oven control system is presented in Part I of this report. Part II describes the salient features of a mathematical model of the coking process as developed at the University of London, England. Part III contains copies of the transparencies used in the presentation.

**21491** (CONF-8003114—, pp 491-506) **Energy recovery in coal conversion.** Horton, J.R. (Oak Ridge Y-12 Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Power recovery in coal liquefaction processes is discussed in this report. How much power is available and how to recover it are covered. Some conventional approaches to power recovery are described as well as the lockhopper pumping and power recovery. Diagrams are included. (DMC)

**21492 (DOE/ET/10069—T5) EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Mar 1981. Contract AB01-77ET10069. 392p. (FE—2893-68). Dep. NTIS (US Sales Only).

This Interim Product Quality Report summarizes research efforts to-date directed at end-use applications of raw and upgraded EDS products. The end-use applications, including any upgrading by hydrotreatment required to ensure adequate performance, are identified for products derived from Illinois (Monterey No. 6 mine) and Wyoming (Wyodak mine) coals. The broad objectives of EDS product quality studies are to identify potential end-uses for coal-derived liquids and to evaluate properties of these liquids relative to requirements of these potential applications. Areas pertaining to product quality requiring further development are discussed and are being addressed in the current program. Some sections of the report provide support for more specific conclusions. These sections deal with generalized market projections, properties of EDS streams and their upgrading, as well as extensive end-use test results. Other sections contain data on the in-depth characterization of EDS product streams which serve as a basis for additional conclusions resulting from the EDS product quality program. (1) Consideration of future market needs combined with generic properties of EDS-derived products may suggest a clean product slate (naphtha/distillate) as the most desirable, long-range EDS product objective. (2) Properties of lighter EDS product streams (naphtha, distillate) are essentially independent of liquefaction operating conditions for a given coal. This applies to both coal-only and bottoms recycle operations. (3) With the exception of heterocyclic content, primarily sulfur, properties of lighter EDS product streams (naphtha, distillate) are very nearly coal-independent.

**21493 (DOE/ET/10532—T1) Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, January-March 1981.** Sullivan, R.F.; O'Rear, D.J. (Chevron Research Co., Richmond, CA (USA)). May 1981. Contract AC22-76ET10532. 21p. (FE—2315-63). NTIS, PC A02/MF A01.

Samples of SRC-II naphtha, middle distillate, and heavy distillate were received and analyzed. These samples are part of a planned study of the potential biological hazards of synthetic crudes. These oils will be hydrotreated when DOE provides blend-

ing instructions. Five drums of EDS syncrude made from Big Brown Texas lignite were received and analyzed. The boiling range and other properties of this syncrude are very similar to the properties of the previously studied H-Coal and SRC-II syncrudes. The hydrotreating severities, which were employed to upgrade the H-Coal and SRC-II syncrudes to transportation fuels, are expected to be close to the severities needed for the EDS syncrude.

21494 **(DOE/ET/11429—T1) Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980.** Katzer, J.R.; Stiles, A.B.; Kwart, H. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). 15 Dec 1980. Contract AC22-78ET11429. 167p. NTIS, PC A08/MF A01.

Hydrodenitrogenation of quinoline and decahydroquinoline has been studied employing several catalysts: Bronsted and Lewis acid catalysts without metal, and silica-alumina, γ-alumina and magnesia impregnated with molybdenum, tungsten, nickel or cobalt. Our results show that nitrogen removal rate was highest for molybdenum on alumina and tungsten on silica-alumina or alumina catalysts. Nitrogen abstraction using γ-alumina support is considerably faster than with magnesia support. Several catalysts have been prepared and tested, with the emphasis on understanding the role of acidity in the carbon-nitrogen bond scission reaction. Hydrodenitrogenation of quinoline has been studied by using Ni,Mo/chlorided or fluorided alumina catalysts, with various halide concentrations. Preliminary results from this study indicate that halogenation of γ-alumina catalysts slightly enhanced the hydrogenolysis activity but showed little effect on the hydrogenation activity. Initial results from phenothiazine hydroprocessing show that carbon-sulfur bonds in the reactant are broken much faster than the carbon-nitrogen bonds. Data relevant to this reaction are being evaluated, utilizing kinetic analysis to give quantitative rates of C-N and C-S bond scission and the extents and rates of hydrogenation. Note: this report contains 5th, 6th, 7th and 8th quarterly reports.

21495 **(DOE/ET/13060—T2) Pipeline Gas Demonstration Plant. Phase I. Annual technical progress report, July 1, 1979-June 30, 1980.** (Conoco, Inc., Stamford, CT (USA)). 1980. Contract AC01-77ET13060. 205p. (FE—2542-30). NTIS, PC A10/MF A01.

Contract No. EF-77-C-01-2542 between Conoco Inc., and the US Department of Energy requires Conoco Inc. to design, construct, and operate a demonstration plant for the manufacture of high-Btu gas from bituminous coal. The project is currently in the design phase, which is scheduled for completion by June 30, 1981. During the reporting period of July 1, 1979 through June 30, 1980 the main accomplishments were: near completion of Task II, Demonstration Plant Process Design; Task IV, Demonstration Plant Environmental Analysis, was completed and the Environmental Analysis Report (FE-2542-25 Vols. 1 through 6) was issued; applications have been filed for Prevention of Significant Deterioration (PSD) Permit, Permit to Install (PTI), National Pollution Discharge Elimination System (NPDES) Permit and Permit to Build the Water Intake; DOE has approved all but two of the proprietary process licenses required for the Demonstration Plant; and Conoco Inc. has implemented a configuration and resource control plan to manage engineering change, cost growth, and schedule slippage in the engineering tasks. The main design effort in the final year of Phase I will be directed to Task VI, Demonstration Plant Engineering Design; Task VII, Construction Planning; and Task X, Long Lead Time Items.

21496 **(DOE/ET/13395—T1) Enthalpy measurement of coal-derived liquids. Final technical progress report.** Kidnay, A.J.; Yesavage, V.F. (Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering). 1 May 1981. Contract AC22-79ET13395. 36p. NTIS, PC A03/MF A01.

This final report presents the results of the enthalpy measurements on the model compound m-cresol. The measurements cover the temperature range 200 to 740°F and the pressure range 200 to 1500 psia. These data are compared with earlier data taken on m-cresol and with other thermophysical properties taken from the literature.

21497 **(DOE/ET/13537—T3) Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report.** Wright, I.G.; Clauer, A.H.; Shetty, D.K.; Peterson, J.H.; Merz, W.E. (Battelle Columbus Labs., OH (USA)). May 1981. Contract AC01-79ET13537. 133p. NTIS, PC A07/MF A01.

The aim of this program was to obtain erosion data on a number of candidate valve materials under a range of slurry erosion conditions which would be useful to valve and process engineers involved in materials selection and valve design. The Battelle slurry erosion rig was used with reconstituted coal-derived slurries to erode candidate materials under a range of slurry velocity and impingement angle conditions. The materials studied were the cemented tungsten carbides: K 701, KZ 701 and K 703; and the ceramics silicon carbide (in the reaction-bonded, CVD and sintered alpha forms) and hot-pressed boron carbide. The erosive nature of slurries from two processes, SRC-1, and H-Coal were also investigated. The size distribution of insoluble solid particles in the slurries examined showed fairly close similarity between different coals processed in one plant, and for a given coal slurry from the two processes. Service trials with a reaction-bonded silicon carbide valve stem in a cemented tungsten carbide seat resulted in what was classified as a premature failure, but provided quite revealing data. The two materials had eroded in the same mode and at the same relative rates as observed in the laboratory rig tests. Analysis of the parts suggested that, in fact, the failure may have resulted from the contour to which the stem was machined rather than from poor materials erosion performance.

21498 **(DOE/ET/14801—12) Gas/slurry flow in coal-liquefaction processes (fluid dynamics in 3-phase flow columns). Quarterly technical progress report, 1 July 1980-30 September 1980.** Ying, D.H.S.; Sivasubramanian, R.; Givens, E.N. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Dec 1980. Contract AC01-79ET14801. 52p. NTIS, PC A04/MF A01.

The 6000 T/D SRC-I demonstration plant will employ vertical tublar reactors feeding slurry and gas concurrently upward. This reactor is essentially an empty vessel with only a distributor plate located near the inlet. Because the commercial plant represents a considerable scale-up over either Wilsonville or Ft. Lewis, this program is addressing the need for additional data on the behavior of three phase systems in large vessels. Parameters are being studied at conditions that relate directly to the projected demonstration plant operating conditions. Air/water/sand 3-phase flow system in both a 5-inch diameter and a 12-inch diameter column is used in this cold-flow simulation study program. The amount of solids retained in the column decreases with increasing column diameter. At the flow conditions designed for the SRC-I demonstration plant, less fine particles (140 mesh minus) accumulated in the 12-inch diameter column than in the 5-inch diameter column. This finding agrees qualitatively with the increase in dispersion with increasing column diameter, thereby leading to the conclusion that there will be practically no accumulation of fines in the demonstration plant dissolver. If the solids are catalytically active, the performance of the demo plant dissolver will be lower than projected because of less solids accumulation. In addition, for a wide range of gas (0.05 to 0.33 ft/sec) and slurry velocities (0.01 to 0.05 ft/sec) covering the designed flow conditions, the amount of retained solids in the 12-inch diameter column is insensitive to the total opening area in the distributor plate and to gas velocity beyond the critical value. However, the amount of accumulated solids continuously increased with decreasing slurry velocity, thus favoring the dissolvers in parallel operation from the solids accumulation stand point.

21499 **(DOE/ET/14806—T2) Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979.** Garg, D.; Givens, E.N.; Clinton, J.H.; Tarrer, A.R.; Guin, J.A.; Curtis, C.W.; Huang, S.M. (Air Products and Chemicals, Inc., Trexlertown, PA (USA)). Dec 1979. Contract AC22-79ET14806. 70p. NTIS, PC A04/MF A01.

This report describes work done in the first quarter of a study of the role of coal minerals and by-product metallic wastes in coal liquefaction. Samples of Elkhorn No. 3 coal, SRC-II Fuel Oil

Blend, Robena pyrite and magnetite, and various other minerals were acquired. SRC-II Fuel Oil Blend was distilled to obtain the 550°F+ fraction which will be used for coal liquefaction runs. The thermal stability of pyrite and other minerals was evaluated by thermal gravimetric analysis (TGA) in the presence of helium and hydrogen gases. Magnetite and zinc flue dusts (high and low zinc content) were found to be thermally stable in the inert atmosphere. Stoichiometric reduction of magnetite with hydrogen was obtained. Zinc flue dusts lost a maximum of 20% weight in the presence of hydrogen. Fly ash samples lost a maximum of 8% weight in the presence of helium and hydrogen gases. Stoichiometric reduction of Robena pyrite was observed both in helium and hydrogen gases. A pressurized thermal gravimetric reactor (PTGR) was used to determine the reactivity of the different minerals. The reduction of pyrite in the PTGR increased linearly with temperature, but the influence of hydrogen pressure was insignificant. The pyrolysis of pyrite was found to be an endothermic process, whereas oxidation of pyrite was exothermic. In batch autoclave tests, the Elkhorn No. 3 coal with 13.35% ash had 87% coal dissolution at 410°C and 1250 psig hydrogen pressure (at 25°C). Pyrite and several other minerals showed little improvement in naphthalene hydrogenation activity, whereas treated pyrite and pyrrhotite significantly improved this hydrogenation activity.

**21500 (DOE/ET/14806—T3) Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, December 1, 1979-February 29, 1980.** Garg, D.; Givens, E.N.; Clinton, J.H.; Tarrer, A.R.; Guin, J.A.; Curtis, C.W.; Huang, S.M. (Air Products and Chemicals, Inc., Trexlertown, PA (USA)). Mar 1980. Contract AC22-79ET14806. 111p. NTIS, PC A06/MF A01.

This report describes work done in study of the role of coal minerals and by-product metallic wastes in coal liquefaction. Samples of Elkhorn No. 3 coal (Letcher County, Kentucky), Robena pyrite and several minerals and metallic by-product waste were acquired. The thermal behavior of various minerals and metallic by-product wastes was evaluated by thermal gravimetric analysis (TGA) and differential thermal analysis (DTA) in the presence of hydrogen, nitrogen and air. The coal process development unit was operated for 220 hours to obtain baseline data and provide information on the catalytic activity of Robena pyrite in solvent hydrogenation and coal liquefaction. We established that the base line reaction conditions to evaluate the activity of the various minerals, metallic wastes and by-products will be a tubing-bomb reactor of 46.3 ml volume at a reaction temperature of 450°C for reaction times of 60 minutes. The reduced pyrite, Robena pyrite and Siniola Mexico pyrite were found to give similar product distribution and coal conversion. The oil production in the cases of reduced pyrite and pyrite was 4 times higher than that of no-catalyst run. Iron oxide ($Fe_2O_3$) was shown to give slightly higher coal conversion and oil production that pyrites and reduced pyrite. Presulfided Co-Mo-Al was found to give the highest coal conversion and oil production. The increase in oil production in the case of Co-Mo-Al was due to the conversion of both asphaltenes and preasphaltenes.

**21501 (DOE/EV/10237—2) Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981.** Lee, M.L.; Castle, R.N. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry). 1981. Contract AC02-79EV10237. 181p. NTIS, PC A09/MF A01.

The sulfur heterocycle separation scheme which was described in the last progress report was evaluated for quantitative recovery of individual components. The results indicate that recoveries can range from 10% to ~ 30% depending on the structure of the compound. During this period, 23 unsubstituted sulfur-containing heterocyclic ring systems were synthesized in oder to confirm GC/MS identifications and for biological testing. The four possible 3-ring heterocycles and the thirteen possible 4-ring heterocycles were tested for mutagenic activity in the histidine reversion (Ames assay) system. One of the 3-ring isomers, naphtho[1,2-b]-thiophene, and six of the 4-ring isomers induced mutations in Salmonella test strains. One of these compounds, phenanthro[3,4-b]thiophene, displayed approximately the same mutagenic activity as benzo[a]pyrene. A two-step adsorption chromatographic procedure was developed in order to fractionate synthetic fuels into various chemical-type classes for studying the relative concentrations and mutagenic activities of the various types. An SRC-II Heavy Distillate was fractionated into aliphatic hydrocarbons, polycyclic aromatic hydrocarbons, sulfur heterocycles, indoles and carbazoles, azaarenes, and amino polycyclic aromatic hydrocarbons. It was found that the amino-PAH fraction contained most of the mutagenic activity. A survey was made for compounds containing both nitrogen and sulfur heteroatoms in their structures. A number of these compounds were detected by GC using nitrogen- and sulfur-selective detection.

**21502 (DOE/FC/02101—T1) Conversion of solvent refined lignite into premium liquid fuels. Annual report, January-December, 1980.** Baltisberger, R.J.; Stenberg, V.I.; Klabunde, K.J.; Woolsey, N.F. (North Dakota Univ., Grand Forks (USA)). Apr 1981. Contract AB18-78FC02101. 85p. NTIS, PC A05/MF A01.

Comparison of three preasphaltene samples separated from three lignite derived samples obtained from GFETC prepared at 404, 460 and 480°C shows that increased temperature tends to produce higher molecular weight preasphaltene fractions containing more aromatic carbons with fewer acid (phenolic) sites per molecule. Ether cleavage studies of the model compounds; diphenyl ether, bibenzothiophene, dibenzofuran and anisole, show that partial or complete ether cleavage was obtained with sodium in hexamethyl phosphoramide solvent. Thus a careful consideration of acidity before and after cleavage can now give a measure of the diaryl ether content of a mixture. This reaction may be useful in coal liquid analysis. Denitrification of N,N-Dimethylamine without aromatic ring reduction occurs with CO-$H_2O$ and $H_2$ at 425°C in about 13% conversion. The optimum of 21 conditions gave a 19% conversion which occurs at 150 psi $H_2S$ and 750 psi $H_2$. Thus, $H_2S$ enhances nitrogen removal from this model compound. Using ESR dispersion techniques we have shown the presence of a second CO radical species on MgO, probably CO-.. observed by ESR, treatment of carbon monoxide radical species on both CO and MgO with $CO_2$ or $H_2O$ causes a destruction of one of the radical species at a rate greater than that of the other.

**21503 (DOE/PC/30072—T3) Studies of the mechanism of coal hydrogenation by electron spin resonance. Quarterly technical progress report No. 4, 1 September 1980-31 November 1980.** Goldberg, I.B. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). May 1981. Contract AC22-80PC30072. 11p. NTIS, PC A02/MF A01.

The objective of this program is to understand and quantify the role of radicals in the hydrogenation and/or liquefaction of coal. To accomplish this goal, coal is treated with $H_2$ in the presence or absence of donor solvent at 400 to 450°C within an EPR cavity. The time dependence of the composition, g-factors and linewidths of the radicals generated during conversion are monitored. The rapid heater unit was improved for reasons discussed in the text. A new Bruker 22OD EPR spectrometer (Corporate Funding) was received.

**21504 (DOE/PC/30198—T3) Safety analysis of the CSTR-1 bench-scale coal liquefaction unit.** Hulburt, D.A. (Hercules, Inc., Cumberland, MD (USA). Hercules Aerospace Div.). May 1981. Contract AC22-80PC30198. 98p. NTIS, PC A05/MF A01.

The objective of the program reported herein was to provide a Safety Analysis of the CSTR-1 bench scale unit located in Building 167 at the Pittsburgh Energy Technology Center. It was apparent that considerable effort was expended in the design and construction of the unit, and in the development of operating procedures, with regard to safety. Exhaust ventilation, $H_2$ and $H_2S$ monitoring, overpressure protection, overtemperature protection, and interlock systems have been provided. Present settings on the pressure and temperature safety systems are too high, however, to insure prevention of vessel deformation or damage in all cases. While the occurrence of catastrophic rupture of a system pressure vessel (e.g., reactor, high pressure separators) is unlikely, the potential consequences to personnel are severe. Feasibility of providing shielding for these components should be considered. A more probable mode of vessel failure in the event of overpressure or overtemperature and failure of the safety system is yielding of the closure bolts followed by high pressure flow across the mating surfaces. As

a minimum, shielding should be designed to restrict travel of resultant spray. The requirements for personal protective equipment are presently stated in rather broad and general terms in the operating procedures. Safe practices and procedures would be more assured if specific requirements were stated and included for each operational step. Recommendations were developed for all hazards triggered by the guidelines.

**21505 (DOE/PC/30198—T5) Safety analysis of the 1000 lb/day coal-liquefaction PDU.** Hulburt, D.A. (Hercules, Inc., Cumberland, MD (USA). Allegany Ballistics Lab.). May 1981. Contract AC22-80PC30198. 75p. NTIS, PC A04/MF A01.

The objective of the program reported herein was to provide a Safety Analysis of the 1000 lb/day PDU located in Building 83 at the Pittsburgh Energy Technology Center. Risks to personnel from potential process hazards are largely controlled by installation of a major portion of the unit within a hot cell. This segregates and isolates personnel from a majority of potential equipment rupture and fire/explosion hazards. Equipment within the cell is subject to potential risks associated with overpressurization or excessively high temperature, and fire/explosion due to ignition of leaking flammable gas (i.e. $H_2$). There are some existing safeguards designed to protect against overpressure or high temperature. Additional safeguards are offered to minimize these risks. The hot cell is provided with general dilution ventilation and hydrogen monitoring. However, confinement effects and potential ignition sources are such that avoidance of formation and ignition of flammable mixtures cannot be assured. Potential health hazards relate to contact with coal-derived liquids or inhalation of irritant or toxic gases, vapors, or dusts, associated with slurry preparation, sampling, draw down of catch-pots, or cleaning of centrifuge bowls. No particularly serious workplace safety hazards were identified, and environmental concerns are largely limited by the relatively low throughput for the unit. A number of Category I hazards with Remote likelihood, and Category II hazards with May Occur likelihood, were identified. Recommendations were developed for these hazards. Implementation of these recommendations will materially reduce the overall risk level of the operation. The Safety Analysis was based on a site visit, process flow diagrams, material balance, equipment data, and operating procedures provided to Hercules, or as represented to Hercules, by the Pittsburgh Energy Technology Center. A detailed listing of the data and information package is documented in Appendix A.

**21506 (DOE/PC/30221—T1) Geotechnical studies related to in situ lignite-gasification trials. Semi-annual technical report, October 1, 1980-March 31, 1981.** Hoskins, E.R.; Russell, J.E. (Texas A and M Univ., College Station (USA)). Apr 1981. Contract FG22-80PC30221. 50p. NTIS, PC A03/MF A01.

The Petroleum Engineering Department at Texas A & M University has conducted field tests on in situ gasification of lignite first at the Easterwood Site near the main campus during 1978 and more recently at the Rockdale Site adjacent to the Sandow Mine near the town of Rockdale in Milam County, Texas. The present project is related to the gasification trials at the Rockdale Site. The objective of the current study is to investigate those geotechnical factors that may influence the performance of the in situ gasification process. These factors include: (1) pre-existing fracture patterns in the lignite and their influence on permeability; (2) strength and deformability of the overburden materials and how these properties are changed by the gasification process and their relationship to subsidence; and (3) the size, shape, and orientation of cavities produced by the process and their relationship to local fracture patterns and geologic structure. The current study is necessarily site specific and related to the Rockdale Site. Ultimately, the goal is to develop models that would be adaptable to any site with a minimum amount of site-specific investigation.

**21507 (DOE/PC/30227—T1) Quantitation of the reductive cleavage of aryl ethers of SRC and coals. Semi Annual report, September 1980-March 1981.** Woolsey, N.F.; Bartk, D.E. (North Dakota Univ., Grand Forks (USA)). Apr 1981. Contract FG22-80PC30227. 6p. NTIS, PC A02/MF A01.

During the first period of this contract our work has focused on the synthesis of appropriate aryl ethers to use in testing ether cleavage reactions. These compounds were prepared by standard literature conditions. Generally, an appropriate aryl halide was treated with sodium phenoxide at 150 to 250°C using a copper powder catalyst. After separating from the copper and extracting the unreacted sodium phenoxide with water, the residual crude phenyl ether was purified by crystallization, distillation or column chromatography. Several grams of each ether has been obtained. The study of the reductive cleavage of ethers by electrochemical means has been initiated. Cyclic voltammetry was used to determine the reduction potentials and radical anion stabilities for a series of aryl ethers in N,N′-dimethylformamide (DMF). Table 1 summarizes the ethers, which have been currently investigated by cyclic voltammetry. All of these ethers are reduced to a radical anion in a one-electron step at a platinum electrode in DMF using tetrabutylammonium perchlorate (TBAP) as the supporting electrolyte. The stability of the resultant anion radical of the ether is apparently determined by the ability of the anion to delocalize charge away from the carbon-oxygen bond of the ether. The diphenyl ether radical anion is unstable on the time scale of the electrochemical experiment. For example, the radical anion appears to be virtually absent during the reverse scan at a scan rate of 1.0 V/s. This would imply a half-life of less than $10^{-1}$ seconds for the radical anion of diphenyl ether. In contrast, the radical anion of dibenzofuran is quite stable on the electrochemical experimental time scale; there appears to be very little decomposition of the radical anion at reverse scan rates of 0.01 V/s. This is indicative of a half-life of greater than $10^{2}$ seconds for the dibenzofuran radical anion at 25°C.

**21508 (DOE/RA/20222—T1) Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report.** (Philadelphia Gas Works, PA (USA)). Feb 1981. Contract FG01-79RA20222. 288p. NTIS, PC A13/MF A01.

The objective of this study is to assess the technical and economic feasibility of producing, distributing, selling, and using fuel gas for industrial applications in Philadelphia. The primary driving force for the assessment is the fact that oil users are encountering rapidly escalating fuel costs, and are uncertain about the future availability of low sulfur fuel oil. The situation is also complicated by legislation aimed at reducing oil consumption and by difficulties in assuring a long term supply of natural gas. Early in the gasifier selection study it was decided that the level of risk associated with the gasification process sould be minimal. It was therefore determined that the process should be selected from those commercially proven. The following processes were considered: Lurgi, KT, Winkler, and Wellman-Galusha. From past experience and a knowledge of the characteristics of each gasifier, a list of advantages and disadvantages of each process was formulated. It was concluded that a medium Btu KT gas can be manufactured and distributed at a lower average price than the conservatively projected average price of No. 6 oil, provided that the plant is operated as a base load producer of gas. The methodology used is described, assumptions are detailed and recommendations are made. (LTN)

**21509 (DOE/RA/20222—T2) Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report.** (Philadelphia Gas Works, PA (USA)). Feb 1981. Contract FG01-79RA20222. 203p. NTIS, PC A10/MF A01.

**21510 (DOE/TIC—1021172) Manpower requirements for an emerging energy technology: high-Btu coal gasification.** Donakowski, T.D.; Daniels, E.J. (Institute of Gas Technology, Chicago, IL (USA)). 1980. 13p. NTIS, PC A02/MF A01.

We estimate that the construction of 10 commercial-scale coal gasification systems (mine and gasifier facility) would require about 36,400 basic workers and 41,400 supporting workers. The operation of these systems requires about 18,300 basic workers and 28,700 supporting workers. The construction requirements are based on factored estimates of high-Btu gasification designs; operation requirements are based on modifications of values reported in the literature. A sample of likely coal-gasification counties was used to aggregate labor requirements on a national level, based on a statistical analysis that is consistent with Monte Carlo simulation procedures.

**21511 (EPRI-EM—1815) Evaluation of alloys for fuel cell heat exchangers. Final report.** Perkins, R.A.; Vonk, S.J. (Lockheed Missiles and Space Co., Palo Alto, CA (USA). Lockheed Palo Alto Research Lab.). Apr 1981. 112p. NTIS, PC A06/MF A01.

The results are presented of an investigation to evaluate the behavior of commercial stainless steels, superalloys, and aluminide coatings in both clean (sulfur-free) and raw (1% $H_2S$) gas representative of the Texaco slagging gasifier atmosphere at 1400 to 1800°F (1033 to 1255°K). The goal was to determine which, if any, of these materials is suitable for use in a high temperature heat exchanger operating on intermediate Btu coal gasification atmospheres. It has been found that none of the commercially available alloys or coatings are suitable for use in the raw (1% $H_2S$) gas, even at temperatures as low as 1400°F (1033°K). Materials that are resistant to attack either have a limited life (< 5000 h) or cannot be fabricated as large size heat exchanger components. It is concluded that structural high temperature alloys must be coated for use in the raw gas and that the best coating or cladding materials are Ni-46Cr (IN671 type alloy) and MCrAl with 25 to 40% Cr and 30 to 40% Al (where M is Ni, Co, or Fe or some combination thereof). Heat exchanger components can be clad with Ni-46Cr but the alloy must be modified to improve its reliability and performance in coal conversion atmospheres. The MCrAl coatings have excellent resistance to sulfidation but processes to deposit the coatings on large components must be developed. Ebrite 26-1 and Type 310 stainless have excellent resistance to attack by the clean gas and the latter alloy is recommended as the best material for heat exchanger components that will be coated on the raw gas side. Significant advances in coating technology are required before serious consideration can be given to design of large coated heat exchangers. Recommendations for advancing technology with both types of coating systems are presented.

**21512 Acid gas removal and cryogenic separation of SNG produced from coal.** Tsao, T.R.; Cassano, A.A.; Tao, J.C. (Air Prod and Chem Inc, Allentown, Pa). pp 11-17 of Cryogenic processes and equipment in energy systems conference, 1980. Toscano, W.M.; Longsworth, R.C.; Zimmermann, F.J.; Gottzmann, C.F. (eds.). New York, NY; American Society of Mechanical Engineers (1980).

From Cryogenic processes and equipment conference; San Francisco, CA, USA (19 Aug 1980).

In the progress of coal conversion technology, the Exxon Catalytic Coal Gasification (CCG) process and the Rockwell Short Residence Time Hydropyrolysis (SRTH) process have emerged as two advanced processes to produce pipeline gas. Aiming to improve the economics of producing SNG from coal, Air Products and Chemicals, Inc. under the sponsorship of DOE, has performed an in-depth evaluation of the feasibility and economics of combining the acid gas removal and the cryogenic methane separation units.

**21513 (ORNL/FMP—81/1) AR and TD fossil-energy-materials program. Quarterly progress report, October-December 1980.** (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 424p. NTIS, PC A18/MF A01.

Progress is reported on the development of materials for coal liquefaction, coal gasification, heat engines and heat recovery, and combustion systems. (DLC)

**21514 (ORNL/MIT—326) Hydrodynamics of coal-liquefaction dissolver configurations.** Irwin, C.F.; Sincali, A.J.; Wong, E.W. (Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice). Jun 1981. Contract W-7405-ENG-26. 72p. NTIS, PC A04/MF A01.

The hydrodynamics of two proposed dissolver configurations for the 63.6 kg/s (6000 tpd) SRC-I demonstration plant were examined. Correlations were used to predict the flow patterns, holdups, pressure drops, bubble-size distribution, and axial mixing in the dissolvers and piping. Calculations on the performance of dissolver internals revealed slug flow and related pressure fluctuations may present serious control problems. The dissolver internals will be subject to extreme erosion by solids. Hydrogen mass transfer in the bubbly-flow regime, expected in the dissolver, is not rate-limiting. Liquid axial mixing is significant and will affect the conversion and selectivity. It is recommended that the pressure fluctuations be estimated by dynamic modeling, that the internals be redesigned to reduce the potential for erosion and coking, that the validity of the assumptions be evaluated at system temperature and pressure, and that experimental programs be initiated to correlate flow patterns, gas holdups, and axial dispersion in large-diameter pipes and columns with high gas densities and in the presence of solids.

**21515 (ORNL/TM—7533) Coal conversion solid wastes: characterization for environmental assessment.** Lee, S.Y.; Boegly, W.J. Jr. (Oak Ridge National Lab., TN (USA)). Jun 1981. Contract W-7405-ENG-26. 43p. NTIS, PC A03/MF A01.

Physicochemical and leaching properties of coal conversion solid wastes produced by British Gas-Lurgi, Cogas, and Texaco gasification pilot plants were measured in order to assess the potential environmental impact caused by disposal of these wastes. The British Gas-Lurgi waste was composed of homogeneous calcic aluminosilicate glass with less than 1% of metallic iron particles. Major and trace elements were diluted by the influx of limestone added during the slagging process. The Cogas waste was partially vitrified ferruginous aluminosilicate with a surface occasionally covered by iron oxide coatings. Immiscible iron oxide and iron sulfide phases in the aluminosilicate matrix of ferromagnetic particles were detected. The Texaco gasification waste was composed of sulfur-rich ferruginous aluminosilicate particles, and the surface of the particles was extensively coated by amorphous iron sulfide and occasionally by lepidocrocite. Pyrrhotite mineral was dominant in the ferromagnetic fraction. In spite of wide variations in heavy metal content of the bulk wastes, some of the chalcophile-group elements displayed consistent association in the surface coatings and ferromagnetic fraction of the wastes. The trace element concentrations (Cd, Cr, Pb, As, Hg, Se, Ag) in the solid waste leachates obtained by the proposed ASTM method were below the limits established by the Interim Primary Drinking Water Standard. In equilibrium batch-leaching studies, the first-order dissolution rates of Ca, Al, Fe, Ni, and $SO_4$ from the solid wastes were found to be very slow ($k < 0.17/d$).

**21516 (PNL-SA—8812) Comparison of chemical and mutagenic properties of a coal liquid and a shale oil.** Toste, A.P.; Pelroy, R.A.; Sklarew, D.S. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Dec 1980. Contract AC06-76RL01830. 30p. (CONF-801039—10). NTIS, PC A03/MF A01.

From 20. annual Hanford Life Sciences symposium; Richland, WA, USA (19 Oct 1980).

A fuel distillate blend and a heavy distillate cut from SRC-II and a Paraho shale oil were chemically fractionated by Sephadex LH-20 chromatograhy, TLC and HPLC. Fractions were assayed for mutagenic activity by the Ames assay using Salmonella typhimurium TA98 with S9 and MFAO as metabolic activators. Fractions exhibiting mutagenic activity were characterized by GC-MS. The unfractionated Paraho shale oil was least mutagenic followed by the distillate blend and finally the heavy distillate cut. After Sephadex LH-20 chromatography, non-polar mutagens could not be detected in any of the synfuel samples; moderately polar mutagens made a small contribution to the samples total mutagenicity; most of the mutagenic activity appeared to be due to polar mutagens. After HPLC fractionation, the distillate blend exhibited non-polar mutagenic activity. The shale oil's mutagens ranged from moderately polar to polar. In contrast, the mutagens of the distillate blend and the heavy distillate cut were almost exclusively moderately polar. On the basis of the Ames assay with MFAO and the GC-MS analyses, primary aromatic amines appear to play a central role in the mutagenicity of the coal liquids. In contrast, amines do not appear to contribute as much to the activity of shale oil.

**21517 (UCRL—50026-80-4) LLNL underground coal gasification project. Quarterly progress report, October-December 1980.** Olness, D.U. (ed.). (Lawrence Livermore National Lab., CA (USA)). 26 Jan 1981. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01.

We have continued laboratory studies of forward gasification through drilled holes in small blocks of coal (~ 30 cm on a side).

Such studies give insight into cavity growth mechanisms and particulate production. In addition, we have been developing a mathematical model for these experiments in order to further our understanding of the physical and chemical processes governing the burning of the coal and the growth of the cavity within the block. This model will be adapted, later, to larger-scale coal-block experiments, and finally to full-scale field exoperiments. We hope to obtain scaling laws and other insights from the model. The small-block experiments are beginning to provide information relevant to the early-time cavity growth. The natural extension of these experiments to larger blocks, perhaps 10ft or more on a side, is presently being planned. The large-block tests will be conducted at a mine, where blocks of coal will be isolated by the experimenter; the objective will be to quantify early-time cavity growth. We completed planning for the directionally drilled injection well for DOE Experiment No. 1. Assessment of the data obtained during the various underground coal gasification tests is continuing. Results from the four different diagnostic systems have been combined to produce a description of the shape of the burn cavity as a function of time during the Hoe Creek No. 3 experiment. Groundwater samples from wells located at distances of a few feet to several hundred feet from the gasification cavities have been collected before, during, and after each of the Hoe Creek tests. The analysis of the groundwater contamination data pertinent to the Hoe Creek No. 2 test was completed.

21518 **Peatgas process development status.** Punwani, D.V.; Biljetina, R. (Inst. of Gas Tech., Chicago, IL). pp 355-375 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

The Institute of Gas Technology (IGT) has conducted over 200 peat gasification tests in laboratory-and PDU-scale equipment since 1976. These tests were jointly sponsored by the US Department of Energy (DOE), the Gas Research Institute (GRI), and the Minnesota Gas Company (Minnegasco). During 1974 and 1975, peat gasification work was also conducted under Minnegasco sponsorship. The results of these tests have been very encouraging and show that, on the basis of chemistry and kinetics, peat is an excellent raw material for the production of substitute natural gas (SNG). A peat gasification kinetic model has also been developed from laboratory and PDU data. Cost estimates for commercial operation based on this model show that the conversion of peat of SNG by the IGT PEATGAS process is competitive with other alternative sources of SNG. To further advance peat gasification technology, DOE and GRI began a pilot plant scale program using an existing coal gasification pilot plant facility. This facility has been used since 1971 for the development of the HYGAS SNG process for conversion of coal to SNG. Preparations to use this facility for peat gasification began in April 1980. The installation of new equipment for peat gasification work started in August 1980 when the coal gasification program was completed. This paper reviews the PEATGAS process, its application for the production of various synthetic fuels, and the status of its development.

21519 **CS/R Advanced Peat Hydrogasification Process.** Sprouse, K.M.; Rosemary, J.K.; Friedman, J. (Rockwell International, Canoga Park, CA). pp 377-414 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

Development of the Cities Service/Rockwell (CS/R) Advanced Peat Hydrogasification Process has advanced to the point where reactor performance has been established at a peat throughput of 18 ton/day. These test results extend the existing peat hydrogasification data base to peat throughput levels a hundred times higher than ever tested before and to considerably higher reactor temperatures and pressures. As a result, carbon conversions as high as 85% have been achieved with substitute natural gas (SNG) as the principal product along with the optional coproduction of benzene. Preliminary process economics studies indicate that these very high carbon conversions in conjunction with the coproduction of benzene may allow lower cost process options unavailable for hydrogasification reactors with lower carbon conversions. Results obtained from the second phase of Rockwell's peat hydrogasification program are presented and discussed in detail. These results cover three major areas of study: peat dense-phase solids feeding, hydrogasification entrained flow reactor testing, and preliminary peat process economic evaluations.

21520 **Continued development of a peat biogasification process.** Ruoff, C.F.; Ashare, E.; Sanderson, J.E.; Wise, D.L. (Dynatech R/D Co., Cambridge, MA). pp 459-478 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

Based on the results of an earlier feasibility study, continued development was carried out on a peat biogasification process. The process is based on total wet processing of peat including: a) hydraulic mining and slurry pumping of the wet harvested peat to the processing plant, b) aqueous alkali oxidation of the peat slurry to break the complex peat structure into lower molecular weight fermentable fragments, and c) anaerobic methane fermentation of the cooked peat liquor. The present work has been oriented towards obtaining a definitive process model on which full-scale plant economics may be based. The process model consists of three system components, namely, a) peat solubilizaton, b) peat oxidation, and c) peat fermentation. While both solubilization and oxidation may be carried out in the same reaction vessel, it has been determined that these are two discrete processing steps. Peat solubilization follows first order reaction kinetics with respect to peat and alkali concentrations with a rate constant of k = 258.1 (l/gmole h) at 100°C and an activation energy of E/sub a/ = 5.7 kcal/gmole. The oxidation of solubilized peat has been found to follow second order reaction kinetics for oxygen consumption with an activation energy of 22.6 kcal/gmole. Methane fermentation of the cooked peat or peat liquor follows first order reaction kinetics. Overall, the process development to date indicates that peat biogasification is uniquely suited for recovery of the energy value in peat in the form of pipeline quality gas. Moreover, projections based on experimental work to date indicate decidedly lower capital costs with peat biogasification than with conventional coal gasification technology applied to peat.

21521 **DOE peat program.** Kopstein, M. (Dept. of Energy, Washington, DC). pp 643-646 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

The United States Department of Energy is implementing a broad-based program to develop a technology for converting peat to substitute natural gas in an economical and environmentally acceptable manner. The program is comprised of five project elements: 1) gasification development, 2) resource estimation, 3) dewatering, 4) environmental impact assessment, and 5) Socio-Economic Impact Assessment. Most of the studies being performed for DOE have been formulated to maximize the amount of information that could be extrapolated for other peat energy applications (direct burning/power generation, liquids production, beneficiation, etc.). Project activities range from benchscale dewatering to pilot plant-scale gasification development. The important technical, social, environmental, and economic issues are being addressed in parallel by ongoing DOE projects. Longer-range plans include continuation of program studies into FY 1983. At that time, DOE will evaluate the results and determine the scope and direction of subsequent DOE peat program activities.

21522 **Outlook for in situ gasification of eastern coal.** Martin, J.W.; McClung, J.D.; Liberatore, A.J.; Schrider, L.A. (Morgantown Energy Technology Center, WV). pp 74-87 of Coal management symposium: coal conference and EXPO V. New York, NY; McGraw-Hill, Inc. (1979).

From Coal conference and EXPO V; Louisville, KY, USA (23 Oct 1979).

In situ coal gasification has the potential to quadruple the proven US coal reserves by recovering the energy from coal seams considered to be unmineable using current mining and coal preparation technology. Sufficient data, field test results, and economic studies have been made available for sub-bituminous coal such that industry can begin evaluating the possible commercialization of

UCG in this resource. This is not the case, however, for the higher ranked bituminous coal and efforts are in progress to bring the technology to the same stage of development and to establish a permanent field test data base to facilitate the eventual commercialization of the technology in this valuable resource. The initial step to develop a first-generation in situ gasification process for the deep, thin-seam, swelling bituminous coal is a test of the Linked Vertical Well concept, Pricetown I, at the METC Pricetown Underground Coal Gasification Test Site. Data being obtained from the Pricetown I test are not only providing valuable information for the data base but are also substantiating the information gathered from previously conducted laboratory and modeling studies, the results of which were used to design and plan the test. During FT 1980, the Pricetown I field test will be completed and analyzed and the results will be made available to the successful competitor for the FRP, Assessment of Underground Coal Gasification In Bituminous Coal.Upon completion of the assessment, a directed and coordinated program for the continued development of in situ gasification of bituminous coals, which is consistent with government policy and industry views, will be recommended. If sufficient interest is generated as a result of these efforts, the recommended program will be implemented to develop and commercialize the technology and provide an additional energy option for the use of coal through in situ coal gasification.

21523 **Rockwell international gasifier--flash hydropyrolysis.** Combs, L.P.; Silverman, J.; Friedman, J.; Greene, M.I. (Rockwell Int. USA). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The reactivity of coal with hot, high-pressure hydrogen has been verified and the chemistry of methane synthesis confirmed in laboratory experiments and bench-scale testing. An engineering-scale reactor was needed which can process tons of coal per hour. 11 refs.

21524 **Commercialization of coal gasification, liquefaction, and conversion to electricity.** Gray, R.W. (Memphis Light, Gas and Water, TN). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The Memphis Light, Gas and Water Fuel Gas Demonstration Plant comprises an installation engineered to generate and distribute industrial fuel gas of approximately 300 Btu/SCF. From 2,800 tons of coal per day, the plant will produce 175 million cubic feet of gas daily. The U-GAS process, which utilizes a fluidized bed gasifier, will be used to gasify the coal.

21525 **Commercial scale development of the SRC-II process.** Jackson, D.M.; Schmid, B.K. pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

SRC-II is a coal liquefaction process in which raw coal is mixed with a portion of the product slurry and hydrocracked to liquid and gaseous products. The residual coal unconverted to distillate and lighter products is sent to a gasifier to produce hydrogen for the process. A liquid-solid separation step is not required, and the primary product is a distillate fuel oil.

21526 **Gasification combined cycle test facility at Powerton.** Jortberg, R.E. (Commonw Res Corp, Chicago, Ill). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The facility will be built adjacent to the Powerton Generating Station. Lurgi gasifiers were chosen. The combined cycle concept restored the project to economic competitiveness. This type of system has a thermal efficiency of up to five percentage points higher than the conventional fired boiler and turbine generator.

21527 **Status of the Mobil process for converting methanol to high quality gasoline.** Kuo, J.; Schreiner, M. (Mobil Res and Dev Corp, Paulsboro, NJ). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The Mobil process has been scaled up to a 4 barrel-per-day fluid pilot plant. Process can produce gasoline at a cost about 30% lower than the Fischer-Tropsch technology. Advantages are higher thermal efficiency, better gasoline selectivity, lower investment, and simpler processing. 10 refs.

21528 **DOE program for the development of a peat utilization technology.** Kopstein, M. (DOE, USA). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The Department of Energy has generated a program for developing commercial and environmentally acceptable technology for the utilization of U.S. peat by direct combustion and/or conversion to gaseous or liquid synthetic fuels. The kinetics of peat hydrogasification indicate that peat is approximately three times as reactive as lignite.

21529 **Synthane process update, mid-'78.** Lewis, R.; Haynes, W.P.; Strakey, J.P.; Santore, R.R. (US DOE, Pittsburgh, Pa). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The pilot plant is designed to operate at pressures up to 1000 psig with any of the coals or lignites available in the U.S. This paper updates results and experiences with Montana Rosebud and Illinois No. 6 coals. 12 refs.

21530 **Gasifiers in industry: experiences on the first few projects.** McGurl, G.V. (US DOE). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The Gasifiers in Industry program allows construction of several small gasifiers in a relatively short period of time. Six projects chosen for government support were Acurex, University of Minnesota, Pike County, General Refractories, Land O'Lakes and Irvin Industries.

21531 **SNG from peat by the PEATGAS process.** Punwani, D.V.; Arora, J.L.; Tsaros, C.L. pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The Institute of Gas Technology process for the conversion of peat to substitute natural gas having a heating value of about 960 Btu per SCF consists of a two-stage reactor incorporating a dilute-

phase entrained-flow hydrogasification stage followed by a fluidized-bed char gasification stage using steam and oxygen. 10 refs.

21532 **Westinghouse coal gasification system.** Salvador, L.A.; Holmgren, J.D. (Westinghouse Electr Corp, Madison, Pa). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The primary goal of the program has been development of a low-Btu process for fueling a gas turbine combined-cycle power plant. A second goal is to develop the technology for medium-Btu applications based on modification of the air-blown, low-Btu gasifier to an oxygen-blown gasifier.

21533 **High mass flux gasifier.** Simpkin, A.J. (Bell Aerosp Textron, Buffalo, NY). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The Department of Energy awarded a contract to investigate the feasibility of using an entrained flow gasifier, operating at high mass throughputs, to economically convert coal into gas. Sixty-six gasification tests have been conducted using an air blown reactor which processes 0.5 tons of coal per hour and operates at a total mass throughput of nominally 10,000 pounds per hour per cubic foot of reactor volume.

21534 **Gasification of caking coals in the BGC/Lurgi slagging gasifier--a status report.** Sudbury, J.D.; Curran, G.P.; Phinney, J.A. (Conoco Coal Dev Co, Library, Pa). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

The British Gas/Lurgi slagging gasifier is capable of processing caking Eastern coals at high production rates. The process is ready for application in a demonstration plant, washed coals will be the preferred feedstock. 8 refs.

21535 **(DOE/ET/13060—T1) Demonstration plant process design. Phase I. The Pipeline Gas Demonstration Plant. Volume 1. Executive summary.** (Conoco, Inc., Stamford, CT (USA)). [nd]. Contract AC01-77ET13060. 31p. (FE—2542-28(Vol.1)). NTIS, PC A03/MF A01.

Conoco Inc. has selected a process for manufacturing high-Btu pipeline quality gas from high-sulfur, bituminous caking coals. The process is based on British Gas/Lurgi slagging gasification technology and shift/methanation technology developed by Conoco Inc. A Demonstration Plant based on the CONOCO PROCESS is being designed under Contract No. EF-77-C-01-2542 with the United States Department of Energy. The process design has been completed, and the project engineering design is in progress. A five volume report of the process design has been issued. This is Volume 1, the Executive Summary. A 1245 acre site for the Demonstration Plant has been selected in Noble County, Ohio. This site is large enough to permit an expansion of the Demonstration Plant so that it could be operated as a commercial venture, if desired. The Demonstration Plant consists of 12 processing units and eight offsite units. The Demonstration Plant is designed to verify the technology required for the CONOCO PROCESS and to evaluate the economics, environmental impacts, and safety aspects of the process so that a commercial plant can be designed in a safe, economical, and environmentally acceptable manner. While portions of the CONOCO PROCESS are based on emerging technology, the technological and environmental risks are low to moderate. Conoco Inc. believes the risks are acceptable and the process is ready for demonstration. A preliminary (budget) estimate of the erected plant cost is 187 million dollars. This estimate does not include a contingency.

## 0106 Properties

*REFER ALSO TO CITATION(S) 21516, 21543*

21536 **(DOE/ER/01198—1351) Analytical transmission electron microscopy in minerals processing.** Fraser, H.L.; Hsieh, K.C.; Twigg, M.E. (Illinois Univ., Urbana (USA)). 1981. Contract AC02-76ER01198. 16p. NTIS, PC A02/MF A01.

A review of the possibilities of performing microchemical analysis in thin sections using a combination of scanning transmission electron microscopy and energy dispersive spectroscopy of x-rays is given. Particular attention is paid to the factors that limit accurate analysis at the highest spatial resolution. As an example of the use of these techniques applied to a potential problem in minerals processing, the identification of pyrite and pyrrhotite particles in Illinois, Herrin # 6 coal is presented.

21537 **Determination of sulfur heterocycles in coal liquids and shale oils.** Willey, C.; Iwao, M.; Castle, R.N.; Lee, M.L. (Brigham Young Univ., Provo, UT). *Analytical Chemistry ;* **53**: No. 3, 400-407(Mar 1981).

Sulfur heterocycles are found in low concentrations in most coal-derived liquids and shale oils, and therefore, isolation of the heterocyclic sulfur fraction is necessary for individual compound identification. A new methodology for the isolation and subsequent separation and identification of sulfur heterocycles is described and applied to selected coal liquids and shale oils. Identification was accomplished by sulfur-selective flame photometric detection and comparison of mass spectral and chromatographic retention data of mixture components with standard reference compounds. Chromatographic retention data for 32 standard sulfur heterocycles were determined.

## 0108 Waste Management

*REFER ALSO TO CITATION(S) 22008, 22240, 22723*

21538 **(DOE/MC/08004—T8) Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979.** Ruch, R.R.; Russell, S.J.; Malhotra, R.; Cahill, R.A.; Frost, J.K.; Steele, J.D.; Thomas, J.; Ashby, J.F.; Bhagwat, S.B. (Illinois State Geological Survey, Urbana (USA)). 19 Apr 1979. Contract AC21-76MC08004. 14p. NTIS, PC A02/MF A01.

Included in the list of US imports in 1974 are metals for which a substantial quantity of reserves within the US have been identified; however, in most cases extraction of these metals would involve higher costs than imported prices. The 33 elements for which over 25% of the total US need was met through imports in 1974 include: Pd, Hf, Pt, Ni, Sb, I, Hg, Th, Al, F, Sr, Tl, Cr, Sn, Bi, W, Co, Ta, Ag, In, Mn, Cd, Zn, Te, Ge, Ti, Au, Se, Ba, Sc, As, Fe, and V. A comparison of this list with elements found in the coal liquefaction residue shows that with the exception of I, Hg, F, Te, and Se, all the 28 other elements are present in the coal liquefaction residues in varying concentrations. Their economic significance will depend not only upon the demand-supply factors but also upon the feasibility of their recovery, both technical and economical. To further determine metals of economic value, the second criteria used is the projected growth in demand. An examination of the US Bureau of Mines Projections shows that there are 30 elements for which the demand by the year 2000 would more than double. The demand for two elements - thorium and cesium - is projected to increase by more than 1000% by the year 2000. In addition there are four elements for which the demand is projected to increase more than 200% between 1974 and 2000. These include uranium, hydrogen, beryllium and gallium. The other elements for which demand is projected to increase by more than 100% inluded: V, Au, O, Cl, Se, Al, B, Li, W, Zr, Br, F, Mg, Mo, Sb, Hf, Ti, I, Ta, N, Cu, S, Zn and Cd. With the demand for these elements projected to increase dramatically over the next two decades, procurement of some of these elements could become difficult. All but Cl, Se, Br, F, I, N, and S are present in varying concentrations in the liquefaction residues.

**21539 (ORNL/MIT—327) Recovery of aluminum from coal fly-ash by HCl sparge crystallization.** Griffin, T.P.; Dolan, J.F. (Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice). Jun 1981. Contract W-7405-ENG-26. 64p. NTIS, PC A04/MF A01.

Sparge crystallization is a step in a process for removing toxic minor components from coal-combustion fly ash and for recovering major components such as aluminum from this material. Sparge crystallization with HCl gas was evaluated as a method of recovering aluminum from flyash leachate. The effect of HCl concentration upon crystal production and purity for feeds with such impurities as Fe, Ca, K, Mg, and Na was studied. Solubility data found here agree with published data. Separation factors for these impurities fall into three groups: the factors for sodium were near unity because it crystallized; Mg and K fell around $10^{-2}$, and Ca and Fe were nearer $10^{-3}$. Optimal crystallization occurred with the HCl concentration range from 30 to 32 wt %. The purity specification on alumina is sufficiently stringent that both crystallization and wash are important to its attainment. The materials of concern are potassium and magnesium. A theoretical approach based on the work of Meissner and modified here provides a framework for predicting solubilities in the aluminum chloride-hydrochloric acid system. Based on experimental and theoretical considerations, it was concluded that a two-stage process would be required to reduce all the impurities in actual fly-ash leachate to acceptable levels.

## 0109 Environmental Aspects

*REFER ALSO TO CITATION(S) 21515, 21517, 21521, 21553, 21556, 21565, 22464, 22536, 22537, 22539, 22540, 22545, 22553, 22598, 22606, 22651, 22709*

**21540 (ANL/EES-TM—130) Air quality analysis of Phase I of the proposed oil backout legislation.** Streets, D.G. (Argonne National Lab., IL (USA)). Oct 1980. Contract W-31-109-ENG-38. 85p. NTIS, PC A05/MF A01.

This report presents an air quality analysis of Phase I of the President's proposed legislation to reduce the use of oil and natural gas in electric utility power plants by approximately 1 x $10^6$ barrels of oil per day. The report analyzes changes in sulfur dioxide and nitrogen oxide emissions that would accompany the conversions. Local and regional impacts on ambient sulfur dioxide and sulfate concentrations are examined. Finally, the cost-effectiveness of certain control options and the effectiveness of converting the specified plants in reducing oil consumption without excessive environmental or cost impacts are discussed. Separate abstracts are prepared for the 6 chapters.

**21541 (ANL/EES-TM—130, pp 10-25) Regional and national $SO_2$ emissions.** Oct 1980. NTIS, PC A05/MF A01.

In Air quality analysis of Phase I of the proposed oil backout legislation.

Sulfur dioxide emissions from the 50 plants specified in Phase I of the proposed legislation were calculated at the plant level for the following cases: current actual emissions, based on the sulfur content of the oil burned in December 1979; allowable emissions for oil combustion (100% of oil SIP levels); allowable emissions for coal combustion (100% of coal SIP levels); allowable emissions for coal combustion with a ceiling on emissions ((100% of coal SIP levels with a 2-lb/$10^6$-Btu ceiling); estimated emissions after conversion (80% of coal SIP levels); and estimated emissions after conversion with a ceiling on emissions (80% of coal SIP levels with a 2-lb/$10^6$-Btu ceiling).

**21542 (DOE/ET/10466—T1) Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities.** Northrop, G.M.; D'Ambra, C.A. (Center for the Environment and Man, Inc., Hartford, CT (USA)). Nov 1980. Contract AC02-77ET10466. 390p. (COO—4575-2). NTIS, PC A17/MF A01.

Environmental and socioeconomic impacts likely to occur during the operational phase of two coal liquefaction processes have been evaluated with SELECS (Site Evaluation for Energy Conversion Systems) for each of six potential sites in Kentucky for commercial scale facilities capable of processing about 26,000 tons of coal per stream day. The processes considered in this evaluation are SRC-I, a direct liquefaction route with solid boiler fuel as the principal product, and Coal-to-Methanol-to-Gasoline, an indirect liquefaction route with transportation fuel as the primary product. For comparative purposes, the impacts of a 2-gigawatt coal-fired steam-electric power plant (with coal requirements comparable to the liquefaction facilities) and an automobile parts manufacturing plant (with employment requirements of 849, comparable to the liquefaction facilities) have also been evaluated at each site. At each site, impacts have been evaluated for one or two nearby cities or towns and four to six counties where significant impacts might be expected. The SELECS methodology affords a well-organized and efficient approach to collecting and assessing a large volume of data needed to comprehensively determine the potential socioeconomic and environmental impacts resulting from the implementation of commercial scale synfuel and other energy conversion facilities. This study has also shown that SELECS is equally applicable to determine the impacts of other facilities, such as automobile parts manufacturing. In brief, the SELECS methodology serves the purpose of objectively screening sites in order to choose one at which adverse impacts will be least, and/or to determine what aspect of a proposed facility might be modified to lessen impacts at a specific site.

## 0110 Reserves And Exploration

**21543 (DOE/FC/10066—T1(Vol.2)) Low-rank coal study : national needs for resource development. Volume 2. Resource characterization.** (Energy Resources Co., Inc., Walnut Creek, CA (USA)). Nov 1980. Contract AC18-79FC10066. 279p. NTIS, PC A13/MF A01.

Comprehensive data are presented on the quantity, quality, and distribution of low-rank coal (subbituminous and lignite) deposits in the United States. The major lignite-bearing areas are the Fort Union Region and the Gulf Lignite Region, with the predominant strippable reserves being in the states of North Dakota, Montana, and Texas. The largest subbituminous coal deposits are in the Powder River Region of Montana and Wyoming, The San Juan Basin of New Mexico, and in Northern Alaska. For each of the low-rank coal-bearing regions, descriptions are provided of the geology; strippable reserves; active and planned mines; classification of identified resources by depth, seam thickness, sulfur content, and ash content; overburden characteristics; aquifers; and coal properties and characteristics. Low-rank coals are distinguished from bituminous coals by unique chemical and physical properties that affect their behavior in extraction, utilization, or conversion processes. The most characteristic properties of the organic fraction of low-rank coals are the high inherent moisture and oxygen contents, and the correspondingly low heating value. Mineral matter (ash) contents and compositions of all coals are highly variable; however, low-rank coals tend to have a higher proportion of the alkali components CaO, MgO, and $Na_2O$. About 90% of the reserve base of US low-rank coal has less than one percent sulfur. Water resources in the major low-rank coal-bearing regions tend to have highly seasonal availabilities. Some areas appear to have ample water resources to support major new coal projects; in other areas such as Texas, water supplies may be constraining factor on development.

**21544 (DOE/FC/10066—T1(Vol.6)) Low-rank coal study: national needs for resource development. Volume 6. Peat.** (Energy Resources Co., Inc., Walnut Creek, CA (USA)). Nov 1980. Contract AC18-79FC10066. 36p. NTIS, PC A03/MF A01.

The requirements and potential for development of US peat resources for energy use are reviewed. Factors analyzed include the occurrence and properties of major peat deposits; technologies for extraction, dewatering, preparation, combustion, and conversion of peat to solid, liquid, or gaseous fuels; environmental, regulatory, and market constraints; and research, development, and demonstration (RD and D) needs. Based on a review of existing research efforts, recommendations are made for a comprehensive national RD and D program to enhance the use of peat as an energy source.

**21545 (ICTIS/TR—13) Geophysical examination of coal deposits.** Jackson, L.J. (International Energy Agency Coal Research, London (UK)). Apr 1981. 116p. NTIS (US Sales Only), PC A06/MF A01.

In recent years, the coal industry has focussed its attention on geophysical techniques in the solution of mining problems and as an aid to mine planning. One important application of geophysics is in the various techniques of geophysical borehole logging. Since there are large contrasts in physical properties between coal and the other rocks normally found in a coal deposit, the responses of the coal seams to logging tools, each measuring a different physical characteristic of the rocks, may be easily recognized on the logging records. Based upon information from the logs, cores for laboratory analysis are only cut from selected sections of the borehole. In addition, information about the density and chemical composition of the coal may be obtained. Another geophysical technique which has been used with great success in coal deposits is seismic surveying. Surface seismic reflection surveys using two-dimensional arrays of seismic sources and detectors have been found in areas of simple geology to be capable of detecting faults with throws as small as 3 m at depths of 800 m. In geologically disturbed areas, good results have been obtained from three-dimensional surveys. Still smaller faults as far as 500 m in advance of the working face may be detected using in-seam seismic surveying conducted from a roadway or working face. Small disturbances have also been detected successfully by pulse radar and continuous wave electromagnetic methods either from within boreholes or from underground. The range of these techniques is at present smaller than that of the seismic techniques. Other geophysical techniques which exploit the electrical, magnetic, gravitational, and geothermal properties of rocks have been found capable of locating abandoned mine shafts and other subsurface cavities at old mining sites and of delineating areas of clinkered rocks.

**21546 (SAND—81-1069C) Applications of reflection seismics to mapping coal-seam structure and discontinuities.** Dobecki, T.L.; Bartel, L.C. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 7p. (CONF-810714—1). NTIS, PC A02/MF A01.

From Conference on ground control in mining; Morgantown, WV, USA (27 Jul 1981).

As a means of demonstrating the effectiveness of reflection seismology in determining continuity of coal seams, three US field projects are reviewed. The three projects involve coals of varied thickness (2 to 14 m) and age (Pennsylvanian to Eocene) from three coal areas of the US (Pennsylvania, Wyoming, and Washington). Each projet also employed its own particular seismic technique, recording system, and seismic energy source although all are considered state-of-the-art, high resolution, digital seismic surveys. Project 1 (thin, Pennsylvania coal) sought detection of sand channels using dynamite and standard in-line (2-D) seismic technique. Project 2 (thick, Wyoming underground coal gasification) involved a gas-explosion (Dinoseis) source with areal (3-D) acquisition methods. Project 3 (thick Washington underground coal gasification) employed a shotgun-type source and standard in-line methods. Data processing was handled by different contractors for each project. Each project was successful in accomplishing its own particular objective; however, data quality and interpretation seem to be more a function of thickness of the target seam, complexity of the overburden, and processing contractor than a seismic source, acquisition scheme (2-D versus 3-D), or recording instrumentation.

**21547 Peat as an energy alternative.** Chicago, IL; Institute of Gas Technology (1980). 777p. (CONF-801252—). $50.00.

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

This symposium, Peat as an Energy Alternative, was organized to facilitate in-depth discussion of the various topics at the last conference. The scope of the symposium was international and included papers from Brazil, Canada, Finland, Israel, Jamaica, and Sweden. The presentations were designed to provide the latest information relating to the following areas of interest: peat resources; peat deposit location; countries using peat for energy; countries showing inerest in considering peat for energy; status of the technologies for harvesting, dewatering, beneficiation, combustion, and conversion to synthetic fuels; environmental and socioeconomic issues relating to large-scale peat utilization; peat reclamation options; Federal and State government plans for peat utilization; and organizations working on developments relating to peat as an energy alternative. The symposium, sponsored by the Institute of Gas Technology, was held at Arlington, VA, December 1-3, 1980. Forth-six papers have been entered individually into EDB and ten also into ERA; two paper had been entered previously from other sources. (LTN)

**21548 Michigan's organic soils - an immense untapped energy resource.** Bourdo, E.A. Jr. (Michigan Technological Univ., Houghton). pp 51-68 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

The US Department of Energy sponsored Michigan Peat Resource Estimation Project is intended to determine the energy potential of Michigan's peat resources. In order to benefit from work previously performed by soil scientists and geologists, the State of Michigan has been divided into 16 soil-geomorphic provinces. Within each soil-geomorphic province, individual peat types, defined by the USDA Soil Conservation Service as organic soil series, are being investigated. Laboratory and field investigations evaluate the energy potentials and classifications of each organic soil series within a province. All data on the Rifle peat type, one of the most widespread in Michigan, have so far established that all such peat is of fuel-grade. Province III appears at this writing to be the most attractive location for any peat energy venture that may be considered for Michigan. Because Michigan data will be summarized by soil series within soil-geomorphic province and will be classified according the USDA Soil Conservation Service standards, Michigan information should be readily interpretable (and quite likely even adaptable) in other states, at least those in the north. Moreover, it is contemplated that energy values for the whole state can be obtained in four years of field work so long as funding is available at projected levels.

**21549 Peat resource estimation project in Minnesota.** Malterer, T.J. (Minnesota Dept. of Natural Resources, Hibbing). pp 69-75 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

The Minnesota Department of Natural Resources, under a US Department of Energy grant, is undertaking a three-year statewide peat resource estimation project. The project is an acceleration of an ongoing DNR resource estimation project. The primary DOE objective is to identify the location, amount, and energy value of Minnesota's peat. Initial work has been concentrated on survey work in Koochiching and Aitkin countries. The two countries have approximately 1.53 million acres of peat, which is about 20 percent of Minnesota's 7.2 million acres. A total of 554 peat samples were collected and sent to the DOE for energy related analyses. Results for Koochiching County are complete, but the Aitkin County results have not been totally completed. Koochiching County was found to have 1.14 million acres of peat with an average depth of 4.7 feet. Peat that was found to be deeper than five feet accounted for 393,180 acres, had energy values greater than 8,000 Btu/lb, with a total of approximately 9.9 x $10^{15}$ Btu's. Similar information for Aitkin County will soon be available. As the total resource estimation nears completion, the amount and quality of Minnesota peats can be measured within the State and between other states.

**21550 Peat resources of South Carolina.** Cohen, A.D. (Univ. of South Carolina, Columbia); Tisdale, M.; Corvinum, D.; Olson, N.K.; Abbott, W.; Vigerstad, T. pp 79-107 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

Under DOE Contract, a study was initiated in August 1979 to determine the magnitude and characterize the peat resources of South Carolina. Sizeable peat deposits were found in 7 Coastal Plain Counties. Colleton County has some of the largest deposits in South Carolina, with peats covering approximately 17,000 acres and averaging about 6 feet thick. Jasper, Georgetown, and Horry

Counties also have large deposits occupying 15,000 to 20,000 acres of each county; but these have not yet been adequately surveyed. The peats in South Carolina are dominantly woody and grass-sedge types averaging 9,800 Btu/lb (dry), 5% ash, and tend to be highly decomposed (< 33% fiber).

**21551 Maine peat resource evaluation program.** Davis, J. (Office of Energy Resources, Augusta, ME). pp 109-121 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

A primary purpose of these studies has been to identify the location of individual peat deposits and to provide some baseline information concerning peatland utilization. While the total peatland area believed to be available ranges from 500,000 to 750,000 acres, these estimates are based upon a history of individual and incomplete examinations of the peat resource. Peatlands are distributed throughout the State; however, a major concentration of individual deposits are located in the eastern and northeastern counties. Current trends and research in peat-energy application suggest several potential end-use applications which may be potentially suitable for Maine. European experiences with energy produced from peat, while not directly analogous with Maine's economic and environmental setting, indicates that a variety of industrial and commercial applications of peat, such as briquetting, or pelletization, or direct combustion are commercially competitive with imported petroleum fuels at the present time. Processed peat in the form of fuels at the present time. Processed peat in the form of briquettes and/or pellets could be used in a wide variety of situations from domestic space heating to industrial and commercial boiler fuels. However, the mining of peat for energy has a variety of economic and environmental concerns which must be addressed previous to the development of any energy policy in Maine which may include peat.

## 0120 Mining

*REFER ALSO TO CITATION(S) 21521, 21547, 21565, 22425*

**21552 (DOE/TIC—1016824) Coal gettability studies: methods of evaluation and verification of coal deposited in seams.** (Centrum Konstrukcyjno-Technologiczne Maszyn Gorniczych, Gliwice (Poland)). 1975. 33p. NTIS, PC A03/MF A01.

Various methods of evaluating the force required to remove coal from the seams are reviewed. (LTN)

**21553 Peatland reclamation - the energy crop option.** Farnham, R.S.; Berguson, W.E.; Levar, T.E.; Sherf, D.B. (Univ. of Minnesota, St. Paul). pp 635-642 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

Peatland research in Minnesota has indicated that a number of vegetable, agronomic and bioenergy crops are suitable for reclamation of mined peatland deposits or for production on present surface soils. Potential bioenergy crops include Salix (willow), Alnus (alder), hybrid Populus (poplar), Typha (cattail), Phragmites (rushes) and other wetland species. Clonal selections of Salix from Sweden and Minnesota, and Alnus species from the USA and Europe have been obtained for research and Minnesota peatlands. A recent inventory indicates that Minnesota has seven million hectares of mineral and organic wetlands. This wetland resource includes many large contiguous area which may be used for renewable bioenergy crop production.

**21554 The US Department of Energy's coal mining research.** Schmidt, W.B. pp vp of World coal prospects. Geneva, Switzerland; United Nations, Economic Commission for Europe (1979).

From United Nations symposium on world coal production; Katowice, Poland (Oct 1979).

The Department of Energy coal mining research program began in the US Bureau of Mines in 1975. The program has been supported at the 45-65 million dollar per year level of funding for the last 5 years. This more than doubled the Federal Government's previous financial support. While there are no statistics available for the industry's own research and development expenditures, the total Federal research and development investment now probably more than equals the private sector research investment. The following R and D projects of the DOE are described: I. underground coal mining: mine development (shaft sinking and horizontal development using tunnel-boring machines), continuous mining (integration of the continuous miner with roof bolter, developing a coal haulage machine which is designed to triple the output of the existing systems), longwall mining (developing 'Americanized' technology); II. surface mining: haulback method of contour mining (proper configuration of hopper, shiftable conveyor, and slewing discharge conveyor), overburden transport (a device to provide feedback to the operator regarding his performance, draft power sensor for bulldozer operators). Economic effects of introducing new machines and technologies are evaluated.

**21555 (DOE/TIC—1015202) Coal gettability testing: the evaluation methods and coal gettability checking in strata.** (Centrum Konstrukcyjno-Technologiczne Maszyn Gorniczych, Gliwice (Poland)). [nd]. 4p. NTIS, PC A02/MF A01.

## 0130 Transport And Handling

**21556 (DOE/FC/10169—T1) Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report.** Smith, R.T. (Energy Resources Co., Inc., Walnut Creek, CA (USA)). 1 May 1981. Contract AC18-80FC10169. 142p. NTIS, PC A07/MF A01.

Peat in situ contains up to 90% moisture, with about 50% of this moisture trapped as a colloidal gel. This colloidal moisture cannot be removed by conventional dewatering methods (filter presses, etc.) and must be removed by thermal drying, solvent extraction, or solar drying before the peat can be utilized as a fuel feedstock for direct combustion or gasification. To circumvent the drying problem, alternative technologies such as wet oxidation, wet carbonization, and biogasification are possible for producing energy or enhanced fuel from peat. This report describes these three alternative technologies, calculates material balances for given raw peat feed rates of 1000 tph, and evaluates the environmental consequences of all process effluent discharges. Wastewater discharges represent the most significant effluent due to the relatively large quantities of water removed during processing. Treated process water returned to the harvested bog may force in situ, acidic bog water into recieving streams, disrupting local aquatic ecosystems.

**21557 (DOE/TIC—1018563) Investigation of coal preparation processes in the circulating stream of water subjected to pulsation.** Jedo, A. (Centrum Konstrukcyjno-Technologiczne Maszyn Gorniczych, Gliwice (Poland)). Dec 1980. 13p. NTIS, PC A02/MF A01.

On the basis of the Agreement concluded between the US Department of Energy and CKTMG KOMAG, Poland, under number P-44-218 DOE and entitled: Investigation of coal preparation processes in the circulating stream of water subjected to pulsation, the investigation provided for in stage I has been carried out. The title of the investigation is: Testing the equipment of the experimental installation and the jig model without circulating motion. The model of the jig together with its auxiliary installation is incorporated in the equipment of the Coal Preparation Plant in the colliery Zabrze and the investigations of the jig model are so carried out that they are suited to individual operation or as part of the whole plant. During the first half-year 1980 the jig model and its installation was modified and thus it was not possible to start the investigations before August 1980. Apart from the last item of the research programme, all the others have been realized. The last item of the programme, related to the investigation of coal separation process in the jig and the effect of parameters characterizing the pulsation cycle and of quantity of the feed introduced to the jig on this process, will be realized in the first quarter of the year 1981. The OC-8 cylindrical jig is an experimental machine designed for two-product system of beneficiation of coal with particle sizes of 30-0 mm. It incorporates four basic units: box of the jig, desliming screen plate, equipment for producing pulsation of water, and equipment for discharging heavy products.

## 0140 Combustion

*REFER ALSO TO CITATION(S) 21991, 22001, 22002, 22003, 22006, 22240, 22460, 22461*

**21558 (DOE/CS/40037—T1) Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, July 1-September 30, 1979.** West, C.E. (Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.). Sep 1980. Contract AC01-78CS40037. 88p. NTIS, PC A05/MF A01.

The ultimate objective of this program is the commercial demonstration of an efficient, environmentally acceptable coal firing process suitable for implementation on melting furnaces throughout the aluminum industry. To achieve this goal, the program has been divided into two phases. Phase I has begun with the design and construction of a 350 pound (coal) per hour staged slagging cyclone combustor (SSCC) attached to a 7-ft diameter aluminum melting ladle furnace. Process development will culminate with a 1000 pph prototype SSCC firing a 40,000 pound capacity open hearth melting furnace at the Alcoa Laboratories. Phase II implementation is currently planned for Alcoa's Lafayette, IN, Works, where two of the ingot plant's five open hearth melting furnaces will be converted to utilize coal. In addition to confirmation of data gathered in Phase I, the effect of extended production schedule operation on equipment and efficiencies will be determined. This work would begin in 1982 pursuant to technical and economic evaluation of the process development at that time.

**21559 (DOE/CS/40037—T2) Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, October 1-December 31, 1979.** West, C.E. (Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.). Oct 1980. Contract AC01-78CS40037. 56p. NTIS, PC A04/MF A01.

Heaviest acitivity this quarter has been in the area of system design and specification and purchase of system components. Mechanical design is now complete. The design of electrical power, process control and data acquisition systems has begun. Combustor design meetings with General Electric Space Science Labs have resulted in an increasing awareness that analytical flow field modeling of the cyclonic combustor could not only enhance current understanding of the process but also broaden the future scope of implementation. A proposal to add specific additional modeling tasks was presented to the Department of Energy, and is included herein in Appendix B. Equipment procurement will continue and system construction will begin during the next quarter.

**21560** (DOE/ET/15518—3, pp 111-149) **Coal combustion studies. Task 4a.** Mar 1980. NTIS, PC A12/MF A01.

In Key contributions in MHD power generation. Quarterly technical progress report, September 1, 1979-November 30, 1979.

Ash vaporization of 26 mineral species has been measured using both oxidizing and reducing atmospheres, and with a range of particle temperatures. Experiments with and without the presence of a carbon matrix indicate the latter enhances ash vaporization at a rate attributable to reducing reactions. Initial work on analyzing solid pyrolysis and combustion products (chars, tars, soot) is reported, with simultaneous study of physical and chemical surfaces. Direct imaging of internal pore structure (> 50 A) is obtained with transmission electron microscopy. Improvements to the coal combustor model are also discussed. Results from the computer code SHAPE are presented; these give the stream function, static pressure, and velocity distributions within the second stage nozzle of a high-swirl MHD combustor. Based on limited experimental data obtained in the water model test facility, it appears that the turbulence parameters used by D.G. Lilley yield calculated flow field properties which are qualitatively acceptable; refinement of the choice of these parameters will be based on comparisons with future experimental data.

**21561 (DOE/PC/30198—T4) Safety analysis of the 700-horsepower combustion test facility.** Berkey, B.D. (Hercules, Inc., Cumberland, MD (USA). Allegany Ballistics Lab.). May 1981. Contract AC22-80PC30198. 57p. NTIS, PC A04/MF A01.

The objective of the program reported herein was to provide a Safety Analysis of the 700 h.p. Combustion Test Facility located in Building 93 at the Pittsburgh Energy Technology Center. Extensive safety related measures have been incorporated into the design, construction, and operation of the Combustion Test Facility. These include: nitrogen addition to the coal storage bin, slurry hopper, roller mill and pulverizer baghouse, use of low oxygen content combustion gas for coal conveying, an oxygen analyzer for the combustion gas, insulation on hot surfaces, proper classification of electrical equipment, process monitoring instrumentation and a planned remote television monitoring system. Analysis of the system considering these factors has resulted in the determination of overall probabilities of occurrence of hazards as shown in Table I. Implementation of the recommendations in this report will reduce these probabilities as indicated. The identified hazards include coal dust ignition by hot ductwork and equipment, loss of inerting within the coal conveying system leading to a coal dust fire, and ignition of hydrocarbon vapors or spilled oil, or slurry. The possibility of self-heating of coal was investigated. Implementation of the recommendations in this report will reduce the ignition probability to no more than $1 \times 10^{-6}$ per event. In addition to fire and explosion hazards, there are potential exposures to materials which have been identified as hazardous to personal health, such as carbon monoxide, coal dust, hydrocarbon vapors, and oxygen deficient atmosphere, but past monitoring experience has not revealed any problem areas. The major environmental hazard is an oil spill. The facility has a comprehensive spill control plan.

**21562 (DOE/PC/30293—2) Effects of preignition on pulverized-coal combustion. Second quarterly report, 1 January 1981-31 March 1981.** Simons, G.A.; Kothandaraman, G. (Physical Sciences, Inc., Woburn, MA (USA)). Apr 1981. Contract AC22-80PC30293. 51p. (PSI-TR—259). NTIS, PC A04/MF A01.

The technical effort on pore structure optimization is complete. The basic conclusion is that particle size and porosity are the most important physical properties of char when considering char oxidation above 800K. The distribution of porosity with pore size is of secondary importance. The internal surface area and pore aspect ratio have no significant influence on char oxidation above 800K. The apparatus for the bench scale pore evolution experiments has been constructed. Coal samples will be heated at various rates to various final temperatures and the pore structure of the remaining char will be measured. Preliminary data have been analyzed using $N_2$ and $CO_2$ adsorption, Hg porosimetry and Hg and He densities. In future studies, the $CO_2$ and $N_2$ adsorption will be omitted as they have not yielded any surprising empirical results and do not offer any information which is useful to the theory of a tailored pore structure for enhanced char reactivity. The Hg and He densities are important as they yield the char pososity and the Hg porosimetry is important as it yields the size distribution of the large pores which control char oxidation. Both the He pycnometer and Hg porosimeter have been purchased. All future experiments and char analyses will be performed in-house. The theory of pore evolution has been initiated. A statistical description of the pore tree has been developed.

**21563 Pilot plant tests of peat for direct combustion in utility boilers.** Honea, F.I.; Sears, D.R.; Talty, R.D. (Dept. of Energy, Grand Forks, ND). pp 313-336 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

A peat utilization project was initiated to evaluate the direct combustion of peat with coal. This paper presents results of pilot plant tests on peat and peat/coal blends in three test combustors: (a) a 75-lb/h pc--fired furnace used for ash fouling studies, (b) a 75-lb/h pc-fired particulate collection test furnace, and (c) a 20-lb/h atmospheric fluidized-bed combustor. Tests were performed on peats from two areas in Minnesota and one from North Carolina. The peat samples from Minnesota had high ash content (12 to 16 pct ash) and evidenced ash deposition problems, whereas the North Carolina peat had low ash (4 pct), low ash fouling potential, and excellent combustion characteristics. Blends of Minnesota peat with North Dakota high-fouling lignite exhibited high fouling potential, reflecting the effect of the high ash in the peat and the high sodium level in the lignite (ash and sodium are previously verified key factors in ash fouling). Substantial enrichment of sodium in the fly ash

did not compensate for the very low initial sodium in the Minnesota peat. Consequently, the fly ash from Minnesota peat had extraordinarily high electrical resistivity of 2 x $10^{13}$ ohm-cm (300°F) which resulted in inefficient removal by the test electrostatic precipitator. Enrichment factors are reported for major and trace element in fly ash, and for major elements in combustion ash. The good combustion and low ash fouling characteristics of North Carolina peat compared to Minnesota peat indicate that peats from different locations have distinctly different characteristics which are important in determining use for direct combustion.

## 0150 Marketing And Economics

*REFER ALSO TO CITATION(S) 21492, 21508, 21509, 21567*

**21564 Demand for world coal through 1995.** Weigel, H.S. pp vp of World coal prospects. Geneva, Switzerland; United Nations, Economic Commission for Europe (1979).

From United Nations symposium on world coal production; Katowice, Poland (Oct 1979).

Analysis was prepared by the Energy Information Administration (EIA) operating within the US DOE. The projections are based on results of several computer programs. It is stressed that projections are conditional, based on clearly specified assumptions. It is projected that the world consumption of coal not including countries with centrally planned economies will steadily increase. In 1985 the consumption will range from 1800 to 1900 MMt, in 1990 from 2200 to 2500 MMt, and in 1995 from 2700 to 3200 MMt. Steam coal trade is expected to significantly increase: for the USA 24.2 MMt to 48.6 MMt in comparison to 10.3 MMt in 1976, for Canada 13.6 MMt to 40.7 MMt in 1995 in comparison to 0.6 MMt in 1976, for Australia about 19.2 MMt in 1995 in comparison to 3.2 Mt. in 1976, South Africa and India 46.4 MMt in 1995 in comparison to 6.5 MMt in 1976 and Poland 22.7 MMt in 1995 in comparison to 27.7 MMt in 1976. The projected steam coal imports of EEC countries will grow to: 49.7 MMt to 64.9 MMt in 1985, 53.0 MMt to 72.5 MMt in 1990, 65.2 MMt to 92.4 Mt in 1995. Steam coal imports of other OECD countries will also be increasing. An increasing proportion of coal fired electric power generation is also anticipated. In 1995 coal combustion will produce 55% to 63% of energy in USA, 10% to 13% in Japan and 25% to 31% in EEC countries. (3 refs.)

**21565 Environmental issues and strategies for peat energy development in the US.** Walters, A.B.; King, R.J.; Richardson, S.I. (UOP/SDC, McLean, VA). pp 581-593 of Peat as an energy alternative. Chicago, IL; Institute of Gas Technology (1980).

From IGT symposium on peat as an energy alternative; Arlington, VA, USA (1 Dec 1980).

Environmental issues associated with generic peat-energy projects have been identified. Impact assessments for individual peat-energy projects will require detailed, site-specific analyses. The need to assess distant, off-site effects and multi-project cummulative effects will complicate impact assessment. Much of the information needed for environmental impact assessments is lacking. The existing environmental data from other types of development activities in wetland areas need detailed interpretive analyses before being used to predict impacts from the development of peatlands for energy. The US DOE program to develop a data base and a strategy for supporting a programmatic environmental assessment of large-scale peat energy use is expected to produce much of the missing information. This DOE program will support the assessment of cumulative regional effects of several individual projects operating concurrently, or sequentially, in a given peat-rich region. Site-specific data will have to be developed separately by each developer for each individual peat energy project. Revisions to Federal and state land-use policies are needed for large-scale peat energy development in many peat-rich regions of the US Current policies were developed without adequately considering the energy potential of US peat and the benefits of carefully planned land reclamation. Other environmental regulations need to be tailored to the specific characteristics of peat energy technology to enable peat to make its fullest contribution as a US energy resource.

**21566 Coal management symposium: coal conference and EXPO V.** New York, NY; McGraw-Hill, Inc. (1979). 106p. (CONF-7910117—(Vol.2)).

From Coal conference and EXPO V; Louisville, KY, USA (23 Oct 1979).

The texts of presentations made at the coal symposium are published in this volume. The subjects included are: coal marketing concepts; government research programs; permitting; and an update on future coal markets. Separate abstracts for each presentation were prepared for inclusion in the Energy Data Base. (DMC)

## 0160 Health And Safety

*REFER ALSO TO CITATION(S) 21504, 21516*

## 0170 Legislation And Regulations

*REFER ALSO TO CITATION(S) 21495, 21566, 22124*

**21567 (DOE/FC/10066—T1(Vol.4)) Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses.** (Energy Resources Co., Inc., Walnut Creek, CA (USA)). Nov 1980. Contract AC18-79FC10666. 241p. NTIS, PC A11/MF A01.

The regulatory, environmental, and market constraints to development of US low-rank coal resources are analyzed. Government-imposed environmental and regulatory requirements are among the most important factors that determine the markets for low-rank coal and the technology used in the extraction, delivery, and utilization systems. Both state and federal controls are examined, in light of available data on impacts and effluents associated with major low-rank coal development efforts. The market analysis examines both the penetration of existing markets by low-rank coal and the evolution of potential markets in the future. The electric utility industry consumes about 99 percent of the total low-rank coal production. This use in utility boilers rose dramatically in the 1970's and is expected to continue to grow rapidly. In the late 1980's and 1990's, industrial direct use of low-rank coal and the production of synthetic fuels are expected to start growing as major new markets.

# 02 PETROLEUM

## 0201 Reserves

**21568** (CONF-791016—, pp 223-225) **Analysis of a statistical model to predict future oil.** Schuenemeyer, J.H. (Univ. of Delaware, Newark). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

Many techniques are used to estimate the total amount of oil remaining to be discovered. However, another important problem is the estimation of the oil that may be found by the next increment of exploratory effort. The search for oil may be characterized as a trial and error process in which fields are found by the siting of exploratory wells. When the search area is restricted to a geologically homogeneous region, called a play, the historical drilling and discovery data exhibit sufficient statistical regularity to permit estimation of future oil by field size class. The form of the statistical model discussed in this paper is based upon two important observations, namely that large oil fields tend to be found during the early stages of exploration and that most of the oil is in the large fields. These factors permit the formulation of a forecasting model based upon the discovery process. The measure of search effort in this model is the area exhausted or condemned by exploratory wells. Procedures to estimate the discovery efficiency and the effective play size from the data are discussed. The model uses these estimates to predict future oil by field size classes for some future number of exploratory wells.

## 0203 Drilling And Production

*REFER ALSO TO CITATION(S) 22125*

**21569 (DOE/BC/10300—10) Use of microorganisms in enhanced oil recovery.** Clark, J.B.; Munnecke, D.; Knapp, R.; Menzie, D. (Oklahoma Univ., Norman (USA)). 27 May 1981. Contract AS19-80BC10300. 6p. NTIS, PC A02/MF A01.

Progress is reported in the following areas: sterilization of cores was achieved by using a $ClO_2$ solution (OXINE) at a concentration of 2000 ppM for 18 hours inside the core, and sterilization of flow tubing and valves was done by autoclaving at 121°C for 20 minutes; the problem of high death rate of the indicator organism (Serratia rubidae) in brine solution was resolved by the addition of small amounts (10 to 20 ppM) of Bactopeptone (an enzymatic protein digest) to the brine solution which made it possible for an initial viable population of $10^5$ cells/ml to survive for at least 72 hours; and the best biosurfactant producing organism was identified as Bacillus lichenformis.

**21570 (DOE/ET/12056—11) In-situ combustion models for the steam plateau and for fieldwide oil recovery.** Satman, A.; Brigham, W.E.; Ramey, H.J. Jr. (Stanford Univ., CA (USA). Petroleum Research Inst.). Jun 1981. Contract AC03-76ET12056. 123p. NTIS, PC A06/MF A01. Order Number DE81023779.

In this study, two interrelated parts of the in-situ combustion oil recovery process have been investigated. The steam plateau region of laboratory combustion tube experiments was studied and heat transfer modes describing the steam plateau were defined. The combustion parameters affecting the steam plateau were also studied and evaluated. An analytical heat model was developed which describes the movement of the steam plateau axially along a cylinder with heat loss through an annular insulation. The behavior of the solution was studied to determine the interaction of the heat transfer mechanisms in laboratory cores. The agreement between experimental laboratory temperature profiles and those computed by model were satisfactory. In the second part of the study, correlations were developed to predict field scale recovery of dry in-situ combustion processes. Basically, a case history analysis was made on field tests as a first step. The recovery histories of those field systems were studied. A combination of an engineering and a statistical approach was used to develop the correlations. The match between the correlations and field test results was also satisfactory. The study shows that the recovery correlations developed for dry combustion processes may be used for the recovery prediction of the wet combustion test in which the air-water injected ratio is high. This study also indicated that air injection and/or oil migration losses are important factors affecting the recovery mechanisms of a pilot project. Thus in pilot projects, for the same air injection, the recovery is somewhat less than found in fieldwide cases. The extension of one of the correlations to pilot dry in-situ combustion projects shows that the correlation parameters used to predict field scale recovery appeared to be reasonable as correlating parameters for dry pilot projects.

**21571 (DOE/ET/12082—9) Displacement of oil by carbon dioxide. Final report.** Orr, F.M. Jr.; Taber, J.J. (New Mexico Inst. of Mining and Technology, Socorro (USA)). May 1981. Contract AS21-78ET12082. 167p. NTIS, PC A08/MF A01.

Results of a comprehensive research program on factors influencing $CO_2$ flooding are reported. Equipment constructed for static equilibrium measurements of phase volumes, compositions, densities and viscosities is described. Design of an apparatus used for a variety of displacement tests is also reported. Apparatus and experimental procedures are described for a new experiment in which equilibrium phase compositions can be measured rapidly and continuously. Results of displacements of crude oil from slim tubes, cores and mixing cells are presented and interpreted in terms of detailed measurements of the phase behavior and fluid properties of the $CO_2$-crude oil mixtures. The complex phase behavior of low temperature $CO_2$-crude oil mixtures is described and compared with similar behavior for $CO_2$-alkane mixtures. A simple correlation is offered for the ranges of reservoir temperature and pressure at which liquid-liquid and liquid-liquid-vapor phase behavior should be expected to occur. Direct evidence is presented of the efficiency with which a $CO_2$-rich liquid phase can extract hydrocarbons from a crude oil. A simple one-dimensional process simulator for $CO_2$ flooding applications is described. Simulation results are compared with experimental data from slim tube displacements. Good agreement is reported between calculated and experimental results as long as the volume change of $CO_2$ on mixing with the oil is not too great.Sensitivity of calculated results to phase behavior and fluid properties is discussed. Comparison of displacement results, phase behavior measurements, and model calculations provides strong evidence that the high displacement efficiency which can be obtained when pressure is high enough and viscous fingering is controlled is the result of efficient extraction of a broad range of hydrocarbons by a dense $CO_2$-rich phase which is a liquid if the temperature is below about 50°C (130°F).

**21572 (DOE/ET/12366—22) Residual-oil-saturation-technology test, Bell Creek Field, Montana. Final report.** (Gary Energy Corp., Englewood, CO (USA)). Jun 1981. Contract AC03-78ET12366. 140p. NTIS, PC A07/MF A01.

A field test was conducted of the technology available to measure residual oil saturation following waterflood secondary oil recovery processes. The test was conducted in a new well drilled solely for that purpose, located immediately northwest of the Bell Creek Micellar Polymer Pilot. The area where the test was conducted was originally drilled during 1968, produced by primary until late 1970, and was under line drive waterflood secondary recovery until early 1976, when the area was shut in at waterflood depletion. This report presents the results of tests conducted to determine waterflood residual oil saturation in the Muddy Sandstone reservoir. The engineering techniques used to determine the magnitude and distribution of the remaining oil saturation included both pressure and sidewall cores, conventional well logs (Dual Laterolog - Micro Spherically Focused Log, Dual Induction Log - Spherically Focused Log, Borehole Compensated Sonic Log, Formation Compensated Density-Compensated Neutron Log), Carbon-Oxygen Logs, Dielectric Logs, Nuclear Magnetism Log, Thermal Decay Time Logs, and a Partitioning Tracer Test.

**21573 (SAND—81-0101C) Two-dimensional temperature distribution surrounding an injection well.** Dunn, J.C. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810614—6). NTIS, PC A02/MF A01.

From 16. thermophysics conference; Palo Alto, CA, USA (23 Jun 1981).

A two-dimensional analytical solution is obtained for the steady-state temperature distribution in a porous medium during injection of an incompressible fluid. Energy transfer by radial convection and by both radial and axial conduction are included. Temperatures in the porous medium can be expressed in terms of geometry and a nondimensional Peclet number that includes the injection flow rate and properties of the formation and injected fluid. The solution can be applied to the injection of spent brine in geopressured or geothermal systems where temperature distribution near the injection well is needed in order to predict dissolution of suspended solids Radial and axial temperature distributions are presented as a function of the Peclet number.

**21574 Water-soluble copolymers. I. Synthesis of model dextran-g-polyacrylamides by Fe(II)/$H_2O_2$ initiation and characterization by aqueous size exclusion chromatography.** McCormick, C.L.; Park, L.S. (Univ. of Southern Mississippi, Hattiesburg). *Journal of Applied Polymer Science ;* **26**: No. 5, 1705-1717(May 1981).

Model graft copolymers were synthesized by grafting acrylamide onto dextram (anti M/sub w/ = 500,000) utilizing the Fe(II)/$H_2O_2$ initiation system. Aqueous size exclusion chromatography (SEC) was used to determine the effects of changing reaction parameters on hydrodynamic dimensions of the resulting graft copolymers. It was also possible to optimize reaction conditions yielding the highest viscosity graft copolymer with the least amount of homopolyacrylamide and unreacted substrate. The molecular structures of the graft copolymers were determined by elemental analysis, SEC, and solution viscometry. Selective hydrolysis of the dex-

tran backbone allowed determination of average molecular weight of acrylamide grafts, number of grafting sites, and average molecular weight of the graft copolymers. Rheological studies indicated viscosity and pseudoplastic behavior were largely related to the graft length of the polyacrylamide side chains.

21575 **Model studies of explosive well stimulation techniques.** Fourney, W.L.; Barker, D.B.; Holloway, D.C. (Univ. of Maryland, College Park). Contract AP21-79MC-12577. *International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts ;* **18**: No. 2, 113-127(Apr 1981).

A series of tests were conducted in thick plexiglass blocks to investigate fracture propagation from an explosively charged borehole. Both notched and unnotched boreholes were utilized in the investigation. The notches were used to limit the number of cracks initiated at the borehole which in turn permitted the gases generated from the detonation to be concentrated in driving a fewer number of fractures for further distances. Fluid filled boreholes as well as air filled boreholes were investigated. The fluid filled borehole gives a better coupling with the borehole wall while preventing crushing of the wall as found in fully loaded holes. High speed photography in conjunction with dynamic photoelasticity was used to view the dynamic crack propagation in the grooved borehole models. Pressure and eddy current transducers were used to measure borehole and fracture pressurization and crack opening displacements as functions of time. The tests revealed the existence of a pressure reinforcement effect from the stem in partially loaded air filled boreholes which resulted in very efficient crack propagation. The fractures from the stem area resulted in the blocks being cleaved into two halves while the charge area fractures quickly arrested after approximately one borehole diameter of propagation. The use of notched boreholes was found to enhance fracture propagation distance greatly. Althoughfluid filled boreholes resulted in initiation at lower pressures the resulting fractures appeared to arrest more quickly than fractures driven from air filled boreholes.

21576 **Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems.** Orr, F.M. Jr.; Lien, C.L.; Pelletier, M.T. (New Mexico Inst. of Mining and Tech., Socorro). *American Chemical Society, Division of Petroleum Chemistry, Preprints ;* **26**: No. 1, 132-145(Feb 1981). (CONF-810308—(Vol.1)).

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

This paper reports results of phase behavior experiments with two $CO_2$-hydrocarbon systems: $CO_2$ plus methane ($C_1$) and hexadecane ($C_{16}$), and $CO_2$ mixed with a synthetic oil containing pentane ($C_5$), decane ($C_{10}$), hexadecane ($C_{16}$) and squalane ($C_{30}$). Results of those experiments are compared with the phase behavior of $CO_2$-crude oil systems and with qualitative predictions of the Peng-Robinson equation of state. Results of phase behavior measurements for $CO_2$ and two well characterized hydrocarbon systems indicate that: (1) high pressure samples can be obtained reliably by flushing samples trapped at system temperature and pressure from a liquid sampling valve into a pressure tight syringe; (2) at temperatures below about 50°C, $L_1$-$L_2$-V phase behavior occurs for $CO_2$-hydrocarbon mixtures at pressures near the vapor pressure of $CO_2$; (3) the second liquid phase is predominantly $CO_2$ with some hydrocarbons dissolved in it. The $L_2$ phase extracts hydrocarbons from the oil more efficiently than the vapor phase; (4) at temperatures below 50°C, the range of pressures within which $L_1$-$L_2$-V occurs is bounded above by the vapor pressure of $CO_2$ if methane is not present. If it is, the pressure required to eliminate the vapor phase is somewhat higher than the vapor pressure of $CO_2$ (extrapolated if necessary). A reasonable estimate of the pressure required to produce $L_1$-$L_2$ behavior in $CO_2$-crude oil systems is the vapor pressure plus 1750 kPa; and (5) conclusions about $CO_2$-crude oil displacement mechanisms should be drawn with caution from $CO_2$-synthetic oil displacement studies.

21577 **Linear oil displacement by the emulsion entrapment process.** Schmidt, D.P.; Soo, H.; Radke, C.J. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *American Chemical Society, Division of Petroleum Chemistry, Preprints ;* **26**: No. 1, 169-174(Feb 1981). (CONF-810308—(Vol.1)).

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

Dilute oil-in-water emulsions of mineral oil, carbon tetrachloride and water are shown to aid in the displacement of viscous oils by decreasing the mobility of the aqueous phase. Lessened water mobility is achieved by small oil droplets irreversibly capturing in the porous medium due to straining and interception, thereby lowering the local permeability to water. This phenomenon is directly analogous to the residual resistance factor of high molecular-weight polyacrylamide polymers, and constitutes the entrapment process. A theoretical treatment is presented for dilute emulsion displacement based on a filtration model of emulsion flow in water saturated porous media. Extension of the original theory to long cores and to two-phase flow is outlined. Emulsion retention is found to be larger in cores containing oil, because the emulsion is forced to flow in the smaller channels. A quantitative calculation of this effect is suggested utilizing relative permeability data. Comparison of the theoretical and experimental emulsion displacements shows good agreement after droplet breakthrough. At earlier times, oil production is underestimated. Drop size segregation, not immobilized water, is postulated as an explanation.

21578 **Salting-out and multivalent cation precipitation of anionic surfactants.** Walker, R.D. Jr.; Keppel, R.A.; Cosper, M.B.; Funk, J.J.; Meister, M.J. (Univ. of Florida, Gainesville). Contract AC-1979-BC-10075. *American Chemical Society, Division of Petroleum Chemistry, Preprints ;* **26**: No. 1, 185-194(Feb 1981). (CONF-810308—(Vol.1)).

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

On the basis of the experiments reported here, it appears that both salting-out and multivalent cation precipitation of anionic surfactants are governed by a type of solubility product relationship in the premicellar concentration region, and that the two processes diverge above the CMC owing to different interactions of the cations with the micelles. The Surfactant Precipitation Line (or the Surfactant Salting-Out Line) is intersected by the Surfactant Micellization Line at a point which makes the beginning of the Micellization Saturation Line. This slope appears to depend upon whether or not the cations are selectively bound by the micelles. The common point of intersection represents a Krafft point for the system at the experimental temperature since monomers, micelles and hydrated solid are in equilibrium at that composition. Mixed surfactants behave somewhat differently than pure monoisomeric surfactants owing to selective precipitation of the more insoluble surfactant species and to mixed micelle behavior.

21579 **Adsorption from selected microemulsions onto alumina.** Nunn, C.C.; Schechter, R.S.; Wade, W.H. (Univ. of Texas, Austin). *American Chemical Society, Division of Petroleum Chemistry, Preprints ;* **26**: No. 1, 199-210(Feb 1981). (CONF-810308—(Vol.1)).

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

Adsorption was studied from the microemulsions and excess oil phases. A method was developed based on determining directly the material adsorbed at the solid/solution interface. Change in solution composition was made negligible by initially contacting the adsorbent alumina with a sufficiently large volume of solution. The system studied all contained sodium laurate as surfactant, n-hexanol as cosurfactant, n-decane as oil, NaCl, and water. For the systems studied, those containing oil showed consistently smaller surfactant and alcohol adsorption than systems without oil. The oil adsorbed at low oil/water ratios was found to be substantial, and is attributed to solubilization in hemimicelles. The reason for greatly reduced adsorption from systems with high oil/water ratios is not understood.

21580 **Fundamentals of catalytic and thermal reactions. Catalysis for chemicals and fuels. Chemistry of enhanced oil recovery. Sulfur recovery and utilization.** Rescorla, A.R. (ed.). Washington, DC; American Chemical Society (1981). 348p. (CONF-810308—(Vol.1)). Univ. of Utah, Salt Lake City.

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

This volume contains papers from the following symposia: fundamentals of catalytic and thermal reactions; catalysis for chemicals and fuels; chemistry of enhanced oil recovery; and sulfur recovery and utilization. Included also are abstracts of papers presented at the following two symposia: surface properties of inorganic compounds at elevated temperatures and their relation to catalysis and roles of transition metal complexes in the oxidation of organic substrates.

## 0204 Processing

*REFER ALSO TO CITATION(S) 21580, 22160*

21581 **Electronic structure of hydrodesulfurization catalysts.** Rabitz, S.H.; Chianelli, R.R. (Exxon Research and Engineering Co., Linden, NJ). *American Chemical Society, Division of Petroleum Chemistry, Preprints ;* **26**: No. 2, 377-383(Mar 1981). (CONF-810308—(Vol.2)).

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

A recent systematic study of the ability of the transition metal sulfides to catalyze the hydrodesulfurization (HDS) of dibenzothiophene (DBT) has shown that this ability depends on the position of the transition metal in the periodic table. This study showed that the HDS activity of the transition metal sulfides varies across the periodic table over three orders of magnitude, and that the first row transition metal sulfides are relatively inactive compared to the second and third row transition metal sulfides. In the second and third row, a maximum in catalytic activity is found near Ru or Rh and Os. One important step toward understanding these periodic trends in catalytic activity is clearly a better understanding of the electronic structure of these transition metal sulfides. Although a number of the individual sulfides have been the subject of band structure and cluster calculations, no systematic study based on a consistent set of calculations has previously been reported for this large group of sulfides. Such a study was undertaken and results are reported from the first stage of this study. Results of self consistent field $X\alpha$ (SCF-$X\alpha$) calculations are described for a series of transition metal sulfur clusters representing sulfides of fourteen first and second row transition metals. These results allow one not only to make systematic comparisons of energy levels and charge distributions among the various clusters, but also to begin to view the trends in catalytic activity of the transition metal sulfides in terms of the electronic structure of these materials. Reduced and reduced and sulfided catalyst were examined directly by x-ray fluorescence in the scanning transmission electron microscope (STEM/EDS), the ion-scattering spectrometer (ISS), and x-ray absorption spectroscopy.

21582 **Chemical physics of catalysis. Residium upgrading and coking. Chemistry of engine combustion deposits.** Rescoria, A.R. (ed.). Washington, DC; American Chemical Society (1981). 656p. (CONF-810308—(Vol.2)). J.W. Bunger, Treasurer, University of Utah, Salt Lake City, UT 84112.

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

This volume contains papers from the following symposia: Chemical Physics of Catalysis; Residuum Upgrading and Coking; and Chemistry of Engine Combustion Deposits. Included also are abstracts of papers presented at the following three symposia: Catalytic Process for Synthetic Fuels; Advances in Separation Technology; and Advances in Flue Gas Desulfurization.

## 0207 Marketing And Economics

*REFER ALSO TO CITATION(S) 21492, 21591, 22126*

21583 **(DOE/EIA/06278—T1) Distillate price-monitoring system. Final report.** Tibbetts, G. (Maine State Government, Augusta (USA)). 1977. Contract FC01-78EI06278. 9p. NTIS, PC A02/MF A01.

In June 1977 the Main Office of Energy Resources, (OER), developed the Price Monitoring Survey, (PMS), to collect data to be analyzed and used as an indication of the average price of home heating fuels (Kerosene, No. 2) in the State and with less statistical validity at the county level. From a total population of approximately 500 fuel oil dealers a sample of 32 dealers was selected. The sample was selected from each of Maine's sixteen counties based on population centers with at least one sample point from each county. After sample selection was completed each of the 32 selected fuel oil dealers was telephoned and asked for the retail price of kerosene (number one), and the retail price of number two home heating fuel. In order to facilitate processing of survey results a computer program was developed. The program is interactive and is written in VSAPL. Each time the telephone survey is conducted input is verified and analysis is performed on the IBM-370 model 148 computer at the University of Maine at Orono. The OER believes that the program was a successful attempt to monitor price fluctuations in the home heating oil, retail market and intends to continue the program. It is felt that the program should be expanded to motor gasoline. Tables and graphs relating to the data collected are provided. These attachments depict price fluctuation over time and display the outputs of the program.

21584 **(DOE/EIA/06278—T2) Heating oil supply/price monitoring report: Part I. Historic data, August 1978-July 1979. Part II. Current data, August 1979-May 1980.** (Maine Office of Energy Resources, Augusta (USA)). Aug 1980. Contract FC01-78EI06278. 4 p. NTIS, PC A03/MF A01.

The 1973-1974 oil embargo brought national realization to the importance, and need for the collection and analysis of energy data. The Maine Office of Energy Resources (OER) is responsible for the establishment and implementation of energy plans and policies in the State of Maine. The Supply/Price Monitoring System has been created to assist energy planners both in Maine and the nation. This survey is used to analyze trends in home heating oil supply and price, and as a tool in responding to inquiries from: citizens, other state agencies, federal and local offices, and the Office of the Governor. This report will describe the Supply/Price Monitoring System, and the results obtained from the survey, during the period August 1, 1979 through May 31, 1980. Historical data is also provided as required by the aforementioned agreement between the OER and the US Department of Energy.

21585 **(DOE/EIA/10169—T1) Program to monitor the weekly retail price of home-heating fuel oil No. 2 in the State of New Jersey. Year one final report.** (New Jersey Dept. of Energy, Newark (USA)). Jun 1979. Contract FC01-79EI10169. 7p. NTIS, PC A02/MF A01.

In order to enable the Energy Information Administration (EIA) of the United States Department of Energy (US DOE) to execute its role in monitoring the cost and price movements within the United States' petroleum industry and to perform analyses and projections related to energy supplies, demand, and prices, the US DOE and the New Jersey Department of Energy (NJ DOE) entered into a cooperative agreement effective between February 26, 1979 and May 30, 1979. The NJ DOE agreed to undertake a weekly program to monitor and evaluate price fluctuations of residential heating oil (No. 2) sold in the State of New Jersey. The sample was randomly selected from a list of home heating oil dealers for each county. Each of the heating oil dealers was advised by letter of the overall purpose of the survey and of the specific information which would be requested. The survey was conducted by telephone on each Monday for the period February 26, 1979 through May 30, 1979. The dealers were asked for the discounted price of home heating oil (No. 2) as of the close of business of the preceding Saturday. The discounted price was defined as the gross price less any discount for early cash payment (i.e., 2% discount for payment within 10 days). Overall state maximum, minimum, and mean prices were calculated as well as the mean for each county in New Jersey. These data were reported to the Region II EIA Data Coordinator by letter within one or two days of their compilation. The statewide maximum, minimum, and mean prices were also reported by telephone to the Washington office of the EIA. A table is presented in this report with these data.

**21586 (DOE/EIA/10221—T2) State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980.** Salamandra, J.; Wilson, R. (Connecticut State Government, Hartford (USA)). 1980. Contract FC01-79EI10221. 33p. NTIS, PC A03/MF A01.

The Connecticut Office of Policy and Management, Energy Division, conducted a heating oil monitoring program of Connecticut fuel oil suppliers and dealers. From August 1979, through May 1980, the Energy Division conducted a biweekly price and inventory survey for No. 2 fuel oil and kerosene. The purpose of the survey has been to provide data necessary for the US Department of Energy's Energy Information Administration to execute its role in monitoring cost and price movements within the US petroleum industry and in performing analyses and projections related to energy supplies, demands, and prices for No. 2 fuel oil. The survey has also provided the state of Connecticut with a current, consistent, and reliable set of figures on heating oil prices and inventories and provided a mechanism for handling consumer inquiries concerning price and supply conditions.

**21587 (DOE/EIA/10297—T1) State of Rhode Island No. 2 heating oil data collection program. Final report, August 27, 1979-May 22, 1980.** (Rhode Island State Energy Office, Providence (USA)). Jul 1980. Contract FC01-79EI10297. 20p. NTIS, PC A02/MF A01.

A one-time survey of the approximately 250 No. 2 fuel oil retail dealers in the state of Rhode Island was conducted by the Governor's Energy Office during July and August of 1979. The information that was sought included name of supplier(s), storage capacity, number of customers, historic deliveries and historic inventories. The total number of dealers who responded to each question ranged between 39 and 190. While the participation was somewhat limited, the survey nevertheless provided the Energy Office with its first profile of the state's retail No. 2 heating oil dealers. While the collection of historic data may be of interest, the collection of accurate and up-to-date data on the price and supply of No. 2 oil is absolutely vital to ensure that adequate supplies are available to the approximately 200,000 dependent Rhode Island households. Tables are provided giving the high, low and average prices of retail and wholesale prices of No. 2 heating oils and retailer margins, inventories, and deliveries.

**21588 Effect of OPEC oil pricing on output, prices, and exchange rates in the United States and other industrialized countries.** Fleisig, H. Washington, DC; Congressional Budget Office (1981). 127p. (NP—1902629).

Following each major oil price increase, real gross national product (GNP) has fallen, unemployment and inflation have risen, and exchange rates have moved erratically. But how do oil price increases produce these effects. This paper discusses some of the macroeconomic consequences of too high and rising oil prices, and some of the policy options that might control these effects. It finds that the high and rising price of oil imports from the Organization of Petroleum Exporting Countries (OPEC) burdens the industrial oil-importing countries in two ways. First, because total expenditures on oil rise relative to income, the potential real standard of living in oil-importing countries falls. Together, the countries of the Organization for Economic Cooperation and Development (OECD), for example, may have paid as much as $150 billion more for oil in 1979 than they would have paid in a competitive oil market. Second, the rising oil price increases unemployment and inflation in ways that are difficult for policymakers in oil-importing countries to manage; on the one hand, the rising oil price produces general inflation, and on the other hand, it depresses domestic demand and employment. Policymakers attempt to control part of the inflation, at the cost of increasing unemployment. The total loss in output from the 1974 to 1975 recession, though part of it may have followed from factors unrelated to oil, was about $350 billion.

**21589 NBER working paper series: oil and the dollar. Working Paper No. 554.** Krugman, P. Cambridge, MA; National Bureau of Economic Research (1980). 23p. (NP—1902616).

This paper develops a simple theoretical model of the effect of an oil price increase on exchange rates. The model shows that the direction of this effect depends on a comparison of the direct balance of payments burden of the higher oil price with the indirect balance of payments benefits of OPEC spending and investment. In the short run, what matters is whether the US share of world oil imports is more or less than its share of OPEC asset holdings; in the long run, whether its share of oil imports is more or less than its share of OPEC imports. Casual empiricism suggests that the initial effect and the long run effect will run in opposite directions; an oil price increase will initially lead to dollar appreciation, but eventually leads to dollar depreciation.

## 0209 Environmental Aspects

*REFER ALSO TO CITATION(S) 21541, 22537, 22553*

**21590 United States Depratment of the Interior final environmental impact statement.** New York, NY; Bureau of Land Management (1981). 297p.

The proposed action is the offering of 253 tracts (1,440,376 acres; 582,912 hectares) located from 64 to 113 statute miles offshore New York, New Jersey, Delaware, Maryland and Virginia for leasing in accordance with the Outer Continental Shelf Lands Act, as amended. The tracts lie in average water depths of 295 to 7792 feet (90 to 2375 meters). If implemented, this sale is tentatively scheduled for December, 1981. Alternatives considered include a delay of the sale, cancelling the sale (no action), and four deletion options. The deletion options include: one to protect fisheries resources; one to protect biological resources located in canyons; and two relating to deepwater concerns. All tracts studied pose sole degree of risk to the environment. Mitigating measures, which may reduce the risk, have been identified.

## 0210 Legislation And Regulation

**21591 (ORAU/IEA—81-3(M)) Petroleum refining industry in the 1980s: impact of the National Energy Plan and related legislation.** Phung, D.L.; Barnes, R.N. (Institute for Energy Analysis, Oak Ridge, TN (USA)). Mar 1981. Contract AC05-76OR00033. 38p. NTIS, PC A03/MF A01.

This study assesses the impact of the National Energy Plan (NEP) and related legislation on the petroleum refining industry. Energy programs, including energy conservation and synthetic fuel production, have been rather successful thanks to drastic oil price increases. Environmental laws require an additional investment of up to $20 billion (1980 dollars) by 1990, which represents a price increase of about 7 cents per gallon price increase of gasoline. This increase over a ten-year period is small compared to price increases due to the policies of the Organization of Petroleum Exporting Countries or to domestic price decontrol. A leveling of crude throughput capacity is expected in the petroleum refining industry in the 1980s. However, much more money will still be needed to upgrade the facilities to process more transportation fuel and at the same time reduce emission of pollutants. Also, a restructure of the refining industry in favor of large, integrated, and efficient refineries is expected.

## 0230 Properties

*REFER ALSO TO CITATION(S) 21576, 21578, 21579*

**21592 (DOE/BETC/RI—81/2) Design and testing of a procedure for evaluating fuel-efficient crankcase lubricants.** Naman, T.M. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Apr 1981. 15p. NTIS, PC A02/MF A01.

Experiments were conducted to design and evaluate a procedure for evaluating the fuel efficiency characteristics of crankcase lubricants using the driving cycles of the 1975 Federal Test Procedure and the Highway Fuel Economy Test. Most of the test protocol was based on guidelines proposed by the American Society for Testing and Materials. Three crankcase lubricants and five oil supplements, as well as a baseline lubricant, were used in eight 1980 model-year vehicles of identical make. The vehicles were operated at 75°F (24°C) in closely controlled chassis dynamometer tests designed to detect small changes in fuel efficiency. Results from these

tests showed measurable increases in fuel economy of 0 to 6% with the test lubricants when compared to a common SAE 30 grade oil. These results are not definitive because of lack of quantification of mileage accumulation effects. The test protocol did reduce measurement variability greatly; this procedure can be applied to evaluation of fuel-efficient oils using larger test fleets. A good potential exists for improving the fuel economy of the US automotive fleet. Because of the large quantities of petroleum consumed in the automotive sector, this potential savings translates into conserving a very significant quantity of petroleum.

**21593 (DOE/LETC/RI—81-1) Hydrocarbon type analysis of jet fuels by $^{1}H$ and $^{13}C$ NMR.** Netzel, D.A.; Hunter, P.M. (Department of Energy, Laramie, WY (USA). Laramie Energy Technology Center). May 1981. 83p. NTIS, PC A05/MF A01.

This report describes the application of NMR spectroscopy to the chemical characterization without prior chromatographic separation of jet fuels and various fuel blends containing varying amounts of paraffinic and aromatic constituents. Equations are derived by which the total percent paraffins and aromatics as well as percent monoaromatics and diaromatics can be calculated. Computer programs for the various calculations are included. The results obtained by NMR are compared to those obtained by MS.

## 0240 Storage

**21594 (SAND—80-2871) Strategic petroleum reserve (SPR) geotechnical program management and program plan issue C.** (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 44p. NTIS, PC A03/MF A01.

The program is broken into the following tasks: site characterization, engineering design and evaluation, materials properties, field measurements, instrumentation, engineering management, and geotechnical planning. (DLC)

**21595 (SAND—80-7140) Strategic petroleum reserve (SPR) geological site characterization report, Bayou Choctaw Salt Dome. Sections I and II.** Hogan, R.G. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 236p. NTIS, PC A11/MF A01.

This report comprises two sections: Bayou Choctaw cavern stability issues, and geological site characterization of Bayou Choctaw. (DLC)

## 0250 Combustion

*REFER ALSO TO CITATION(S) 21561, 21582*

**21596 (LBL—12128) Influence of fuel sulfur on the selective reduction of NO by $NH_3$.** Lucas, D.; Brown, N.J. (Lawrence Berkeley Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 8p. (CONF-810704—2). NTIS, PC A02/MF A01.

From 1. international specialists meeting of the Combustion Institute; Bordequx, France (20 Jul 1981).

More intensive regulations of the emissions of nitrogen oxides from stationary combustion sources have prompted the innovation and characterization of new control technologies suitable for applications in utilities. One of the more recent and attractive abatement technologies is the Thermal DeNO/sub x/ process which has been described by Lyon and Longwell. This process removes NO by selectively reducing it with $NH_3$ added to the post-combustion gases containing excess oxygen. This process is thus independent of the NO formation mechanism and makes no distinction between thermal and fuel NO. The present study is concerned with characterizing the selective reduction process for light distillate oil fuel admixed with variable amounts of pyridene and thiophene in a laboratory scale combustion tunnel under a variety of experimental conditions. This paper reports on those aspects of the study concerned with the investigation of possible synergistic effects between the sulfur and selective reduction chemistry.

# 03 NATURAL GAS

## 0302 Geology And Exploration

**21597 (DOE/MC/08216—157) Quantitative analysis of the economically recoverable resource.** Pulle, C.V.; Seskus, A.P. (Science Applications, Inc., Morgantown, WV (USA)). May 1981. Contract AM21-78MC08216. 108p. NTIS, PC A06/MF A01.

The objective of this study is to obtain estimates of the economically recoverable gas in the Appalachian Basin. The estimates were obtained in terms of a probability distribution, which quantifies the inherent uncertainty associated with estimates where geologic and production uncertainties prevail. It is established that well productivity on a county and regional basis is lognormally distributed, and the total recoverable gas is Normally distributed. The expected (mean), total economically recoverable gas is 20.2 trillion cubic feet (TCF) with a standard deviation of 1.6 TCF, conditional on the use of shooting technology on 160-acre well-spacing. From properties of the Normal distribution, it is seen that a 95 percent probability exists for the total recoverable gas to lie between 17.06 and 23.34 TCF. The estimates are sensitive to well spacings and the technology applied to a particular geologic environment. It is observed that with smaller well spacings - for example, at 80 acres - the estimate is substantially increased, and that advanced technology, such as foam fracturing, has the potential of significantly increasing gas recovery. However, the threshold and optimum conditions governing advanced exploitation technology, based on well spacing and other parameters, were not analyzed in this study. Their technological impact on gas recovery is mentioned in the text where relevant; and on the basis of a rough projection an additional 10 TCF could be expected with the use of foam fracturing on wells with initial open flows lower than 300 MCFD. From the exploration point of view, the lognormal distribution of well productivity suggests that even in smaller areas, such as a county basis, intense exploration might be appropriate. This is evident from the small tail probabilities of the lognormal distribution, which represent the small number of wells with relatively very high productivity.

**21598 (METC/EGSP—14) Stratigraphic cross section of the upper Devonian Perrysburg and Java formations and thier equivalents, Northwestern Pennsylvania.** Harper, J.A.; Abel, K.D. (Pennsylvania Dept. of Environmental Resources, Harrisburg (USA). Bureau of Topographic and Geologic Survey). 1981. Contract AS21-76MC05198. 25p. NTIS, PC A02/MF A01.

**21599 (METC/EGSP—816) Stratigraphic cross sections showing members of the New Albany Shale (Devonian and Mississippian) in Indiana.** Hasenmueller, N.R.; Bassett, J.L. (Indiana Geological Survey, Bloomington (USA)). 1980. Contract AC21-76MC05204. 25p. NTIS, PC A02/MF A01.

## 0303 Drilling, Production, And Processing

**21600 Upgrading high-nitrogen natural gas by selective membrane permeation.** Landahl, C.D.; Klass, D.L. Chicago, IL; Institute of Gas Technology (1981). 11p. (CONF-810417—7).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

Substantial natural gas reserves exist in shut-in wells that cannot be produced because the gas contains large concentrations of nonfuel components such as nitrogen and carbon dioxide. In many cases, the excessive cost of upgrading these gases by cryogenic liquefaction and fractionation prohibits their use as pipeline gas. A significant increment of gas could be added to our usable supplies if a low-cost method for methane separation existed. Preliminary experimental work has been done to establish the technical feasibility of membrane separation for high-nitrogen natural gas. An extensive screening of commercial and developmental diffusion membranes revealed only a few that are selective for nitrogen. Polyacrylonitrile (PAN) exhibited the highest nitrogen-methane separation factors of the membranes tested. However, the permeation

rates for PAN are too low for a practical separation system. Evaluation of membranes of PAN with vinyl and other polymers indicated that permeation rates could be increased while still maintaining separation efficiency of PAN in bilayer membranes. The experimental methods and results of this work and the potential value of the composite PAN membrane system are discussed.

### 0308 Environmental Effects

*REFER ALSO TO CITATION(S) 21590*

**21601 Computer modeling of massive LNG spills from storage tanks at Point Conception, Oxnard, and Los Angeles Harbor, California.** Lee, W.H.; Weinstein, M. (Los Alamos Sci Lab, NM). pp 83-99 of Cryogenic processes and equipment in energy systems conference, 1980. Toscano, W.M.; Longsworth, R.C.; Zimmermann, F.J.; Gottzmann, C.F. (eds.). New York, NY; American Society of Mechanical Engineers (1980).

From Cryogenic processes and equipment conference; San Francisco, CA, USA (19 Aug 1980).

A study was made of the effect of a massive LNG spill from storage tanks at Point Conception, Oxnard, and Los Angeles Harbor, California. Computations were made on seasonal and annual bases of the Lower Flammable Limit (LFL) for each site using its climatology. One analysis considered the LNG-water interactions using a Gaussian diffusion model under neutral stability conditions. 29 refs.

### 0309 Artificial Stimulation

*REFER ALSO TO CITATION(S) 21575, 21597*

**21602 (DOE/BC/10003—18) Western Gas Sands Project. Status report, October-November-December 1980.** (CER Corp., Las Vegas, NV (USA)). 1980. Contract AC08-79BC10003. 155p. NTIS, PC A08/MF A01.

Coring and logging operations were completed during the quarter on the following wells: Falcon Oil and Gas 1-33 Milk River in Valley County, Montana; Falcon Oil and Gas 2-21 Federal in Phillips County, Montana; and Mountain Fuel Supply Mesa Unit No. 1, Sublette County, Wyoming. Studies were continued in formation evaluation, improved logging techniques, hydraulic fracturing and fracture conductivity and reservoir simulation. At Lawrence Livermore, theoretical analysis continued on fracture growth in nonuniform stress fields and fluid flow in cracks; laboratory experiments explored hydraulic fractures and rock properties. Activities continued at Los Alamos for developing the NMR logging concept. Sandia conducted a borehole seismic fracture mapping experiment with Esso Resources in a tight gas sand in Alberta, Canada, in conjunction with WGSP work. The fourth phase of well testing for the joint DOE/CIG cyclic dry gas injection experiment was conducted during the quarter with the aid of the DOE Well Test Facility.

**21603 (SAND—81-0225) Direct observation of a sand-propped hydraulic fracture.** Warpinski, N.R.; Tyler, L.D.; Vollendorf, W.C.; Northrop, D.A. (Sandia National Labs., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 65p. NTIS, PC A04/MF A01.

An experiement has been conducted in which a sand-propped hydraulic fracture is created and then mined back to observe fracture behavior and proppant distribution. Three stages of different colored, different concentration sand transported by a water-based gel were injected into a volcanic ash fall tuff formation at a depth of 1400 ft near an existing tunnel complex. The resultant fracture was subsequently mined back for direct observation and photographed and mapped. This particular region was highly faulted and exhibited significant changes in in situ stress magnitudes across the faults; it is felt that this stress distribution resulted in very complex fracture behavior and growth processes. The fracture was bounded on one wing by a fault which was only a few feet from the wellbore. The fracture terminated on top at an unbonded bedding plane. Most of the injected volume of sand and fluid was forced downward, considerably below the elevation where the fracture was initiated. The different colors of sand were randomly distributed, although they were usually found in distinct layers, but this may have been due to the complex growth process. At different locations the fracture was found to have considerable variations in width; from several sand grains wide (1 cm) to devoid of sand altogether (2 to 3 mm average).

**21604 (SAND—81-0703) Transient stress analysis of high-energy gas-fracture experiments.** Chen, E.P. (Sandia National Labs., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 22p. NTIS, PC A02/MF A01.

The elastodynamic solution of a cylindrical hole whose edge is subjected to the action of a transient pulse load was obtained in this report. This problem is of interest to the high energy gas fracture experiments to be conducted at the Nevada Test Site. Laplace transform technique is used to present the result in integral forms. Numerical results have been obtained and are presented in graphical forms.

**21605 (UCRL—85331(Rev.1)) Direct observation of explosively induced damage in sandstone with application to reservoir stimulation.** Durham, W.B. (Lawrence Livermore National Lab., CA (USA)). 1981. Contract W-7405-ENG-48. 10p. (CONF-810410—4(Rev.1)). NTIS, PC A02/MF A01.

From Scanning electron microscopy conference; Dallas, TX, USA (14 Apr 1981).

Samples of a porous, partially saturated, loosely consolidated, gas-bearing greywacke sandstone which had been subjected to explosive loading in the laboratory at three effective confining pressures, 0, 24, and 48 MPa, were observed by scanning electron microscopy. Qualitatively, damage decreased with increasing distance to the shot point. Damage was evident as fracturing and compaction in a zone within 10 mm of the explosion point, and as fracturing without significant volume change to a radius of 20 to 30 mm. An attempt to quantify the relationship between damage and distance for the purpose of verifying modeling predictions produced very imprecise results. Clay particles, chiefly kaolinite, which pervade pre-existing cracks and pores are displaced by the explosion but individually are deformed very little. The clays appear to have the ability to blunt crack tips. Microfractures are typically less than 100 $\mu$m long (one grain diameter or less) and none is longer than 300 $\mu$m. The absence of long fractures suggests that reservoir stimulation by explosive loading in this material does not appear promising.

**21606 Devonian shale.** Washington, DC; National Petroleum Council (1980). 229p. (NP—1902707).

Objectives were to: estimate the in-place gas resource of Devonian Shale in the eastern United States, project possible production volumes and reserve additions of recoverable gas at various price levels with current technology, estimate the potential of new technology and its effect on production and reserve additions, examine constraints of Devonian Shale development, and compare findings with other published studies.

## 04 OIL SHALES AND TAR SANDS

### 0402 Site Geology And Hydrology

*REFER ALSO TO CITATION(S) 21598, 21599*

### 0403 Drilling, Fracturing, And Mining

**21607 (LA—8397-PR) Explosively produced fracture of oil shale, July-September 1979.** Morris, W.A. (comp.). (Los Alamos Scientific Lab., NM (USA)). Mar 1981. Contract W-7405-ENG-36. 30p. NTIS, PC A03/MF A01.

The behavior of cracks in fragmented oil shale is considered from a geometric statistical standpoint, and an expression is derived that gives the distribution of inactive cracks at the late-time asymptotic limit. In addition, the calculated values of the appropriate bulk and shear moduli are compared using an exact solution and the statistical crack model (SCM). This comparison offers increased confidence in the correctness of the model. Initial analysis of stress-

gauge records from the large-scale Colony Mine experiments is presented, and adequate agreement between theory and experiment is shown. Finally, a discussion of flow through a rubble pile, including a specific study of the relative effects of convection vs dispersion of diffusion, is presented. Such studies are essential for quantifying the dependence of resolution on spacing of sampling locations and flow rates.

## 0404 Oil Production, Recovery, And Refining

*REFER ALSO TO CITATION(S) 21516, 21616, 21617, 22037, 22049*

**21608 (DOE/LC/10787—77) Investigation of the geokinetics horizontal in situ oil shale retorting process. Quarterly report, January, February, March 1981.** Hutchinson, D.L. (Geokinetics, Inc., Concord, CA (USA)). May 1981. Contract FC20-78LC10787. 69p. NTIS, PC A04/MF A01.

Retort No. 23 has been heavily instrumented and was ignited on March 16, 1981. A total of 6588 barrels of shale oil have been recovered from Retort No. 24 to date; 6057 barrels of oil were recovered during the quarter, an average of 65 barrels per day. Approximately 4909 barrels of shale oil were shipped by tanker truck to the WESRECO refinery in Salt Lake City, Utah, during the quarter. Drilling of re-entry process and instrumentation wells on Retort No. 25 was completed. A post-burn core sampling program for Retort No. 18 was developed and implemented.

**21609 (LA—8744-MS) Multistage leaching of spent modified in situ oil shale retorts.** Thode, E.F.; Peterson, E.J.; Wagner, P. (Los Alamos Scientific Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01.

With a view toward reducing the various costs associated with environmental control technologies for spent modified in-situ (MIS) oil shale retorts, a concept study of forced multistage leaching of these retorts, followed by surface treatment for removing trace elements, has been conducted. The well-known process of multistage, countercurrent leaching was adapted to the conditions of an MIS retort battery, and energy expenditures for pumping and for water treatment, and water requirements were calculated. In comparing control costs for three individual pore volume leaches with a three-stage countercurrent leach, energy expenditure for leaching a hypothetical 50,000 bbl/day plant was reduced from 9.4 million kWh/yr to 3.9 million kWh/yr. Consumptive use of water for leaching similarly was reduced from 70 million cu ft/yr to 31 million cu ft/yr (1,985,000 $m^3$/yr). The major cost savings were identified to be in the water purification plant investment and size of lined evaporation ponds. Specific site calculations may be made when better information is available on the chemistry of the burned solids and their reaction with leach solutions.

**21610 (SAND—81-1038) Oil shale program. Twentieth quarterly report, October 1980-December 1980.** Bader, B.E. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 62p. NTIS, PC A04/MF A01.

In this report, Sandia in-house activities and field activities (at the Geokinetics Oil Shale Project and the Occidental Oil Shale Project) are described under the headings: bed preparation, bed characterization and evaluation, report characterization and evaluation, and mine stability.

**21611 (UCID—19045) Why solar oil shale retorting produces more oil.** Aiman, W.R. (Lawrence Livermore National Lab., CA (USA)). 20 May 1981. Contract W-7405-ENG-48. 5p. NTIS, PC A02/MF A01.

A solar oil shale retorting process may produce higher oil yield than conventional processing. High oil yield is obtained for three reasons: oil carbonization inside of the shale is reduced, oil cracking outside of the shale is reduced, and oil oxidation is essentially eliminated. Unique capabilities of focused solar energy produce these advantages. An increase in yield will reduce the cost of mining and shale transportation per barrel of oil produced. These cost reductions may justify the increased processing costs that will probably be associated with solar oil shale retorting.

**21612 (UCRL—85845) Ultrasonic thermometry in oil shale retorts.** Ronchetto, J.J. (Lawrence Livermore National Lab., CA (USA)). 6 May 1981. Contract W-7405-ENG-48. 12p. (CONF-810607—1). NTIS, PC A02/MF A01.

From Symposium on instrumentation and control for fossil energy processes; San Francisco, CA, USA (8 Jun 1981).

The method relies on the principles of ultrasonic reflectometry to locate and determine temperatures within zones of a slender-rod-sensing element installed in the in-situ retort bed. The measurement technique consists of sending an ultrasonic pulse down an element containing n zones spaced along its length. The zone boundaries are defined by n + 1 discontinuities within the element. The time intervals between pairs of returning echoes, caused by reflections from these discontinuities, are measured electronically. These measured time intervals are then related to the average temperature of the corresponding zones. Preliminary results are encouraging, and it appears that the ultrasonic thermometer can be a useful in situ instrument.

## 0405 Properties And Composition

*REFER ALSO TO CITATION(S) 21516, 21537, 21593*

**21613 Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina.** Ford, C.D.; Holmes, S.A.; Thompson, L.F.; Latham, D.R. (Dept. of Energy, Laramie, WY). Contract EF-76-C-01-2315. *Analytical Chemistry ;* **53**: No. 6, 831-836(May 1981).

The nitrogen compounds in hydrotreated shale oil products derived from Paraho shale oil are separated into specific nitrogen-type fractions by using basic/neutral alumina adsorption chromatography. The separation scheme, which gives fast and reproducible results, is successfully applied to shale oil products produced under different hydrotreating conditions. These products vary in the level of nitrogen and/or in the distillation range. Infrared spectrometry of the fractions identified three major nitrogen compound types: pyridine-type nitrogen, pyrrole-type nitrogen, and amide-type nitrogen. The distribution of these nitrogen types in various hydrotreated shale oil products is shown.

**21614 Alkanes obtained by thermal conversion of Green River oil-shale kerogen using CO and H/sub 2/O at elevated pressure.** Chong, S.L.; Cummins, J.J.; Robinson, W.E. (US DOE, Laramie, Wyo). *Israel Journal of Technology ;* **17**: No. 1, 36-50(1979).

The alkanes produced from the reaction of Green River oil-shale kerogen with CO and H/sub 2/O at temperatures of 300 to 450/degree/C were characterized by GLC and GC-MS. The amount of alkanes generally increases with increase in reaction temperature, and at 450/degree/C this amount is higher than that produced by the Fischer assay method. This study shows that the isoprenoid-type structures are a significant part of the structure of Green River kerogen, and it appears that the components produced from the kerogen in the CO-H/sub 2/O reaction below 400/degree/C are essentially the same as those in the natural bitumen. A C/sub 21/ isoprenoid chain alkane and 14 tricyclic alkanes not reported before were found in Green River oil shale. 19 refs.

## 0407 Health And Safety

*REFER ALSO TO CITATION(S) 21516*

## 0409 Waste Research And Management

*REFER ALSO TO CITATION(S) 21609*

**21615 (LBL—11214) Wastewater treatment in the oil-shale industry.** Fox, J.P.; Phillips, T.E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1980. Contract W-7405-ENG-48. 48p. (CONF-800822—3). NTIS, PC A03/MF A01.

From Oil shale: the environmental challenges conference; Vail, CO, USA (11 Aug 1980).

Because of the stringent state and federal standards governing the discharge of wastes into local waters and the limited water supplies in this area, an oil shale industry will probably reuse process effluents to the maximum extent possible and evaporate the residuals. Therefore, discharge of effluents into surface and ground waters may not be necessary. This paper reviews the subject of wastewater treatment for an oil shale industry and identifies key issues and research priorities that must be resolved before a large-scale commercial industry can be developed. It focuses on treatment of the waters unique to an oil shale industry: retort water, gas condensate, and mine water. Each presents a unique set of challenges.

### 0410 Enviromental Aspects

*REFER ALSO TO CITATION(S) 21609*

21616 **(LA-UR—81-1196) Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado.** Peterson, E.J.; O'Rourke, J.A.; Wagner, P. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 17p. (CONF-810203—11). NTIS, PC A02/MF A01.

From 110. annual meeting of the AIME; Chicago, IL, USA (22 Feb 1981).

Oil shale retorting induces mineral and chemical reactions to occur on the macroscopic and microscopic levels in the kerogen-bearing marlstone. The nature and extent of the reactions is dependent upon process variables such as maximum temperature, time at temperature, atmosphere, and raw shale composition. This report describes the investigation of the mineral, chemical, and trace element release properties of spent shales retrieved from an experimental in situ retort at Occidental Oil Shale, Inc.'s Logan Wash site in Garfield County, Colorado. Correlation between mineralogy of the spent materials and the mobility of major, minor, and trace elements are indicated, and relationships with important process parameters are discussed. The progress of carbonate decomposition reactions and silication reactions is indicative of the processing conditions experienced by the shale materials and influences the mobility of major, minor, and trace elements when the solids are contacted by water. Shale minerals that are exposed to the extreme conditions reached in underground retorting form high temperature product phases including akermanite-gehlenite and diopside-augite solid solutions, kalsilite, monticellite, and forsterie. The persistence of relatively thermally stable phases, such as quartz, orthoclase, and albite provide insight into the extremes of processing conditions experienced by the spent shales. Leachate compositions suggest that several trace elements, including vanadium, boron, fluoride, and arsenic are not rendered immobile by the formation of the high-temperature silicate product phase akermanite-gehlenite.

21617 **(LBL—11197) Retort abandonment: issues and research needs.** Fox, J.P.; Persoff, P.; Wagner, P.; Peterson, E.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1980. Contract W-7405-ENG-48. 24p. (CONF-800822—5). NTIS, PC A02/MF A01.

From Oil shale: the environmental challenges conference; Vail, CO, USA (11 Aug 1980).

This paper has identified key issues in retort abandonment and has addressed research needs. Retort abandonment for vertical modified in-situ (VMIS) shale oil recovery is an environmentally sensitive research area that has received recognition only within the past five years. Thus, experimental data and information are, in general, limited. In addition, there is presently a wide spectrum of unresolved issues that range from basic problem definition to technical details of potential control technologies. This situation is compounded by the scale of the problem and the absence of a commercial industry. The problems involve large numbers and will require engineering on a gigantic scale. Abandoned retorts are large - up to 700 feet deep and several hundred feet in cross section. They will exist in huge blocks, several square miles in area, which are inaccessible at several thousand feet below the surface. The processes that will ultimately be used to extract the oil are undefined. The technology is in transition, and representative samples of materials have not been available for research. Research efforts in this area have concentrated on basic studies on the nature and magnitude of environmental problems resulting from VMIS oil extraction. These investigations have used laboratory reactors to generate spent shales and modeling studies to predict water quality and hydrologic impacts. The technology for retort abandonment is just now being developed, using engineering analyses to identify promising environmental control options and laboratory and modeling studies to determine feasibility. We expect that, as the environmental problems are better defined and understood, conventional control technologies will prove to be adaptable to a majority of the problems associated with this new process and that laboratory and modeling research on the problem definition will be refocused on technology development and field experiments.

## 05 NUCLEAR FUELS

### 0501 Reserves

21618 (CONF-791016—, pp 209-210) **Help, where are we.** Beckman, R.J. (Los Alamos Scientific Lab., NM). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

Large data set is defined by a set of rules. Use of a preprocessor for looking for outliers in the data is discussed. Questions about data postprocessors are asked. In addition, questions are asked about the analysis of large data sets. Data structures are discussed using the National Uranium Resources Evaluation and US Geological Survey projects as examples.

### 0502 Exploration

*REFER ALSO TO CITATION(S) 22298*

21619 **(CONF-791016—) 1979 DOE statistical symposium.** Gardiner, D.A.; Truett T. (comps. and eds.). (Oak Ridge National Lab., TN (USA)). Sep 1980. Contract W-7405-ENG-26. 240p. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

The 1979 DOE Statistical Symposium was the fifth in the series of annual symposia designed to bring together statisticians and other interested parties who are actively engaged in helping to solve the nation's energy problems. The program included presentations of technical papers centered around exploration and disposal of nuclear fuel, general energy-related topics, and health-related issues, and workshops on model evaluation, risk analysis, analysis of large data sets, and resource estimation.

21620 **(GJBX—35((81)(Vol.2)(PriceSalina)) Aerial radiometric and magnetic survey; Brushy Basin detail survey: Price/Salina national topographic map sheets, Utah. Volume II. Area I: graphic data. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GH01664. 648p. NTIS, PC A99/MF A01.

This volume contains multi-variable radiometric stacked data profiles, magnetic and ancillary stacked data profiles, radiometric and magnetic contour maps, multi-variant map, geochemical flight line composite map, geologic base map, and geologic flight line composite map.

21621 **(GJBX—69(81)) Methods development and applications evaluations of NURE aerial reconnaissance survey data for uranium resource evaluation: Beeville/Bay City and Crystal City quadrangles, Texas.** Adams, J.A.S.; Harrill, S.F.; Oddo, J.E. (Rice Univ., Houston, TX (USA)). Apr 1981. Contract AC08-76NV01183. 115p. NTIS, PC A06/MF A01.

The area studied covers some 50,000 square kilometers of land area in south Texas and is designated the Beeville/Bay City and Crystal City quadrangles, which are bounded by north latitude lines 28° and 29° and west longitude lines 94° and 100°. The NURE open-file reports on the aerial gamma spectrometric, hydrologic, and stream-sediment surveys of this area were studied in regard to their utility in identifying regions of high or higher favorability for

uranium deposits. The investigation concentrated on six formations, three of which were assumed to be favorable and three unfavorable. Traversing a few stationary ground gamma spectrometric determinations were made in connection with the present work. In addition to the 35 new ground determinations on the Beaumont formation, 1500 spectra previously obtained by a helicopter survey from an altitude of 15 meters around the South Texas Nuclear Power Plant Site near Bay City were used in the present study. There is substantial agreement between the NURE aerial data and the ground and helicopter data as regards the general radioelement distributions in the stratigraphic units described above. The vehicle-mounted gamma-ray spectrometer used in this work systematically gave some 30 percent higher thorium concentration estimates when compared with those from the NURE aerial data. The NURE aerial data are adequate in number to characterize the major stratigraphic units, but they may not be quantitative enough for detailed comparisons from one quadrangle to another, and the optimum sampling area for each formation is not known.The development or refinement of a unique geochemical model for the formation of south Texas-type sandstone uranium deposits was not achieved starting with the NURE open-file data and the published literature.

21622 **(GJBX—80(81)) Some concepts of favorability for world-class-type uranium deposits in the northeastern United States.** Adler, H.H. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Mar 1981. Contract AC13-76GJ01664. 150p. NTIS, PC A07/MF A01.

An account is given of concepts of favorability of geologic environments in the eastern United States for uranium deposits of several major types existing elsewhere in the world. The purpose is to convey some initial ideas about the interrelationships of the geology of the eastern United States and the geologic settings of certain of these world-class deposits. The study and report include consideration of uranium deposits other than those generally manifesting the geologic, geochemical and genetic characteristics associated with the conventional sandstone-type ores of the western United States.

21623 **(GJBX—93(81)) Aerial radiometric and magnetic survey: Driggs National Topographic Map, Idaho/Wyoming. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 332p. NTIS, PC E17/MF $20.15.

Includes 118 sheets of 48x reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Driggs National Topographic Map NK12-2 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

21624 **(GJBX—106-81) Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance.** Cook, J.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Mar 1981. Contract AC09-76SR00001. 18p. (DPST—79-146-2S). NTIS, PC E01/MF $3.50.

Includes 4 sheets of 48x reduction microfiche.

Supplemental analytical results are presented for 1094 stream sediment samples that were collected as part of the SRL-NURE reconnaissance in the National Topographic Map Series (NTMS) Portland 1° x 2° quadrangle. Results are reported for 23 elements (U, Ag, As, Ba, Be, Ca, Co, Cr, Cu, K, Li, Mg, Mo, Nb, Ni, P, Pb, Se, Sn, Sr, W, Y, and Zn). Analyses are tabulated and displayed graphically on microfiche. Field data and neutron activation analysis (NAA) were open-filed in DPST-79-146-2 [GJBX-28(79)].

21625 **(GJBX—110-81) Dynamic Test Range I: follow-on. Narrative report.** (L.K.B. Resources, Inc., Syosset, NY (USA)). Jan 1981. Contract AC13-76GJ01664. 156p. NTIS, PC E06/MF $3.50.

The Lake Mead Dynamic Test Range was developed for the purpose of evaluating various range users radiometric equipment, data acquisition techniques and reduction methods. Further, the range is to serve as a calibration standard to assist in the normalization of survey data acquired by any of the several NURE program aerial survey subcontractors. The current project was designed to gather the geologic, magnetic and radiometric data necessary to accomplish the above tasks. A detailed geologic ground study and airborne radiometric survey of Lake Mead Dynamic Test Range I was undertaken by LKB Resources during the period from February to June 1979. This report summarizes the results of this effort in terms of a geologic description of the regional area and a more detailed analysis of the local lithologies present. The airborne survey methods are summarized and the survey results are presented graphically in map form as stacked profiles at a scale of 1:6000.

21626 **(GJBX—111(81)) Aerial radiometric and magnetic study: Wallace National Topographic map, Idaho/Montana. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 272p. NTIS, PC E14/MF $9.65.

Includes 98 sheets of 48x reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Wallace National Topographic Map NL11-3 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

21627 **(GJBX—112(81)) Aerial radiometric and magnetic survey: Grand Junction National Topographic map, Colorado, Utah. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 298p. NTIS, PC E15/MF $18.65.

Includes 108 sheets of 48x reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Grand Junction National Topographic Map NJ12-3 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

21628 **(GJBX—117(81)) Aerial radiometric and magnetic survey: Pullman National Topographic Map, Idaho/Washington. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 268p. NTIS, PC E13/MF $13.40.

Includes 73 sheets of 48x reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Pullman National Topographic Map NL11-5 are presented. The airborne data gathered are reduced by ground computer facilities to

yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

**21629 (GJBX—135-81(Vol.1)) Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach, Seattle, Cape Flattery, Victoria, Quadrangles (Washington). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA)). 1981. Contract AC13-76GJ01664;AC13-79GJ01692. 74p. PCE 13/MF $23.90.

An airborne combined radiometric and magnetic survey was performed for the Department of Energy (DOE) over the area covered by the Copalis Beach, Seattle, Victoria, and Cape Flattery, 1:250,000 National Topographic Map Series (NTMS), quadrangle maps. The survey was part of DOE's National Uranium Resource Evaluation (NRRE) program. Data were collected by helicopters equipped with gamma-ray spectrometers with large crystal volumes, and with high sensitivity proton precession magnetometers. The radiometric systems were calibrated at the Walker Field Calibration pads and the Lake Mead Dynamic Test Range. Data quality was ensured during the survey by daily test flights and equipment checks. Radiometric data were corrected for live time, aircraft and equipment background, cosmic background, atmospheric radon, Compton Scatter, and altitude dependence. The corrected data were statistically evaluated, plotted, and contoured to produce anomaly maps based on the radiometric response of individual geological units. The anomalies were interpreted and an interpretation map produced. Volume I contains a description of the systems used in the survey, a discussion of the calibration of the systems, the data collection procedure, the data processing procedures, the data presentation; the interpretation rationale, and the interpretation methodology. A separate Volume II for each quadrangle contains the data displays and the interpretation results.

**21630 (GJBX—135-81(Vol.2A)) Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach quadrangle (Washington). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1981. Contract AC13-79GJ01692. 118p. NTIS, PC A06/MF A01.

No uranium anomalies meet the minimum statistical requirements as defined. There is no Uranium Anomaly Interpretation Map for the Copalis Beach quadrangle. Potassium (%K), equivalent Uranium (ppM eU), equivalent Thorium (ppM eT), eU/eT, eU/K, eT/K, and magnetic pseudo-contour maps are presented in Appendix E. Stacked Profiles showing geologic strip maps along each flight-line, together with sensor data, and ancillary data are presented in Appendix F. All maps and profiles were prepared on a scale of 1:250,000, but have been reduced to 1:500,000 for presentation.

**21631 (GJBX—135-81(Vol.2B)) Airborne gamma-ray spectrometer and magnetometer survey, Seattle quadrangle (Washington). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1981. Contract AC13-79GJ01692. 153p. NTIS, PC A08/MF A01.

One uranium anomaly meets the minimum statistical requirements as defined. This anomaly is over the potassium (%K) contact area between undifferentiated Tertiary rocks and Pleistocene glacial deposits. Equivalent uranium (ppM eU), equivalent thorium (ppM eT), eU/eT, eU/eK, eT.K, and magnetic pseudo-contour maps are presented in Appendix E. Stacked profiles showing geologic strip maps along each flight-line, together with sensor data, and ancillary data are presented in Appendix F. All maps and profiles were prepared on a scale of 1:250,000, but have been reduced to 1:500,000 for presentation in this report.

**21632 (GJBX—135-81(Vol.2C)) Airborne gamma-ray spectrometer and magnetometer survey: Victoria quadrangle (Washington). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1981. Contract AC13-79GJ01692. 134p. NTIS, PC A07/MF A01.

One uranium anomaly meets the minimum statistical requirements. Potassium (%K), equivalent Uranium (ppM eU), equivalent Thorium (ppM eT), eU/eT, eU/K, eT/K, and magnetic pseudo-contour maps are presented. Stacked Profiles showing geologic strip maps along each flight-line, together with sensor data, and ancillary data are presented. All maps and profiles were prepared on a scale of 1:250,000, but have been reduced to 1:500,000 for presentation. Anomaly # 1 is over an exposure of the Permian Shuksan metamorphic suite which is predominantly phyllite (Trps).

**21633 (GJBX—135-81(Vol.2D)) Airborne gamma-ray spectrometer and magnetometer survey, Cape Flattery quadrange (Washington). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1981. Contract AC13-79GJ01692. 93p. NTIS, PC A05/MF A01.

No uranium anomalies meet the minimum statistical requirements as defined. There is no Uranium Anomaly Interpretation Map for the Cape Flattery quadrangle. Potassium (%K), equivalent Uranium (ppM eU), equivalent Thorium (ppM eT), eU/eT, eU/K, eT/K, and magnetic pseudo-contour maps are presented in Appendix E. Stacked Profiles showing geologic strip maps along each flight-line, together with sensor data, and ancillary data are presented in Appendix F. All maps and profiles were prepared on a scale of 1:250,000, but have been reduced to 1:500,000 for presentation.

**21634 (GJBX—136-81(Vol.1)) Airborne gamma-ray spectrometer and magnetometer survey: Wenatchee, Concrete, quadrangles (Washington). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1981. Contract AC13-79GJ01692. 73p. NTIS, PC E09/MF $15.10.

Includes 64 sheets of 48x reduction microfiche.

An airborne combined radiometric and magnetic survey was performed for the Department of Energy (DOE) over the area covered by the Wenatchee and Concrete, 1:250,000 National Topographic Map Series (NTMS), quadrangle maps. The survey was part of DOE's National Uranium Resource Evaluation (NURE) program. Data were collected by a helicopter equipped with a gamma-ray spectrometer with a large crystal volume, and with a high sensitivity proton precession magnetometer. The radiometric system was calibrated at the Walker Field Calibration pads and the Lake Mead Dynamic Test Range. Data quality was ensured during the survey by daily test flights and equipment checks. Radiometric data were corrected for live time, aircraft and equipment background, cosmic background, atmospheric radon, Compton scatter, and altitude dependence. The corrected data were statistically evaluated, plotted, and contoured to produce anomaly maps based on the radiometric response of individual geological units. The anomalies were interpreted and an interpretation map produced. Volume I contains a description of the systems used in the survey, a discussion of the calibration of the systems, the data collection procedures, the data processing procedures, the data presentation, the interpretation rationale, and the interpretation methodology. A separate Volume II for each quadrangle contains the data displays and the interpretation results.

**21635 (GJBX—136-81(Vol.2A)) Airborne gamma-ray spectrometer and magnetometer survey, Wenatchee quadrangle (Washington). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1981. Contract AC13-79GJ01692. 171p. NTIS, PC A08/MF A01.

Four uranium anomalies meet the minimum statistical requirements as defined. These anomalies are tabulated and are shown on the Uranium Anomaly Interpretation Map. Potassium (%K), equivalent Uranium (ppM eU), equivalent Thorium (ppM eT), eU/eT, eU/K, eT/K, and magnetic pseudo-contour maps are presented in Appendix E. Stacked Profiles showing geologic strip maps along each flight-line, together with sensor data, and ancillary data are

presented in Appendix F. All maps and profiles were prepared on a scale of 1:250,000, but have been reduced to 1:500,000 for presentation. Anomalies # 1 and # 2 are over areas underlain by Tertiary Yakima basalt flows (Ty). Anomaly # 3 is over an area underlain by Tertiary nonmarine shales (Tsh) and Recent alluvium (Qal). Anomaly # 4 is over an area underlain by pre-Jurassic gneiss (pJgn).

21636 **(GJBX—136-81(Vol.2B)) Airborne gamma-ray spectrometer and magnetometer survey: Concrete quadrangle (Washington). Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1981. Contract AC13-79GJ01692. 190p. NTIS, PC A09/MF A01.

Twenty-five uranium anomalies meet the minimum statistical requirements as defined. These anomalies are tabulated and are shown on the Uranium Anomaly Interpretation Map. Potassium (%K), equivalent Uranium (ppM eU), equivalent Thorium (ppM eT), eU/eT, eU/K, eT/K, and magnetic pseudo-contour maps are presented. Stacked Profiles showing geologic strips maps along each flight-line, together with sensor data, and ancillary data are presented. All maps and profiles were prepared on a scale of 1:250,000, but have been reduced to 1:500,000 for presentation.

21637 **(GJBX—137(81)) Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated).** Thayer, P.A.; Cook, J.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jul 1980. Contract AC09-76SR00001. 16p. (DPST—79-146-17). NTIS, PC E02/MF $3.50.

Includes 6 sheets of 48x reduction microfiche.

Sampling in the northern half of the quadrangle was restricted to areas outside the Hopi Indian Reservation. Surface sediment samples were collected at 977 sites, at a target sampling density of one site per 13 square kilometers. Ground water samples were collected at 45 sites in the southwestern part of the quadrangle. Neutron activation analysis results are given for uranium and 16 other elements in sediments, and for uranium and 9 other elements in ground water. Mass spectrometry results are given for helium in ground water. Field measurements and observations are reported for each site. Analytical data and field measurements are presented in tables and maps. Data from ground water sites include: water chemistry measurements (pH, conductivity, and alkalinity); physical measurements where applicable (water temperature, well description, and scintillometer reading); and elemental analyses (U, Al, Br, Cl, Dy, F, He, Mg, Mn, Na, and V). Data from sediment sites include: stream water chemistry measurements from sites where water was available; and elemental analyses for sediment samples (U, Th, Hf, Al, Ce, Dy, Eu, Fe, La, Lu, Mn, Sc, Sm, Na, Ti, V, and Yb). Sample site descriptors are also tabulated. Areal distribution maps, histograms, and cumulative frequency plots for most elements; U/Th, U/Hf, U/(Th + Hf), and Th/La ratios; and scintillometer readings at sediment sample sites are included.Uranium concentrations in sediments of the Flagstaff quadrangle are relatively low, with a maximum value of 11 ppM. The mean of the logs of uranium values in sediments is 0.35, which corresponds to a value of about 2.2 ppM. Highest values occur in areas underlain by Quaternary volcanics and alluvium in the south-western part of the quadrangle, and in lacustrine deposits in the Hopi Buttes area on the eastern edge of the quadrangle. Both of these areas have known uranium occurrences.

21638 **(GJBX—138(81)) Marble Canyon 1° x 2° NTMS area Arizona: data report.** Heffner, J.D. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jul 1980. Contract AC09-76SR00001. 52p. (DPST—79-146-18). NTIS, PC E03/MF $3.50.

Includes 6 sheets of 48x reduction microfiche.

Results of ground water and stream/surface sediment reconnaissance (HSSR) in the National Topographic Map Series (NTMS) Marble Canyon 1° x 2° quadrangle are presented. The target sampling density for all media collected was one site per 12 square kilometers. This resulted in 884 sediment samples being collected; however, dry conditions and sparse population resulted in the collection of only 2 ground water samples. Grand Canyon National Park, Glen Canyon National Recreation Area, and much Indian tribal land in the southern half of the quadrangle were not sampled. Neutron activation analysis (NAA) results are given for uranium and 16 other elements in sediments, and for uranium and 9 other elements in ground water. Mass spectrometry results are given for helium in ground water. Field measurements for sediment samples are presented in tables and maps. Statistical summaries of data and a brief description of results are given. A generalized geologic map and a summary of the geology of the area are included. Data from ground water include: water chemistry measurements (pH, conductivity, and alkalinity); physical measurements (water temperature, and scintillometer readings); and elemental analyses (U, Al, Br, Cl, Dy, F, He, Mg, Mn, Na, and V). Data from sediment sites include: water chemistry measurements (where available) for pH, conductivity, and alkalinity; and elemental analyses(U, Th, Hf, Al, Ce, Dy, Eu, Fe, La, Lu, Mn, Sc, Sm, Na, Ti, V, and Yb). Sample site descriptors (stream characteristics, vegetation, etc.) are also tabulated. Histograms, cumulative frequency, and areal distribution plots for most elements; Log U/Th, Log U/Hf, and Log U/(Th + Hf) ratios; and scintillometer readings are included.

21639 **(GJBX—141(81)) Effects of overburden, biomass and atmospheric inversions on energy and angular distributions of gamma rays from U, K, Th, and airborne radon sources. Final report.** Rubin, R.M.; Leggett, D.; Wells, M.B. (Radiation Research Associates, Inc., Fort Worth, TX (USA)). Dec 1980. Contract AC13-76GJ01664. 274p. (RRA-T—8012). NTIS, PC A12/MF A01.

This report describes a set of radiation transport calculations that were run with the AHISN S/sub n/ discrete ordinates code and a point kernel code to determine the energy, polar angle and height in air distributions of the total and direct gamma-ray flux densities from: (1) uranium sources of 3.2, 200 and 800 ppM in a sandstone orebody covered with biomass densities of 0, 10.2, 20.4, 51.0 and 102.0 kg/m$^2$; (2) thorium sources of 12, 25 and 80 ppM in a sandstone ore body covered with biomass densities of 0, 10.2, 20.4, 51.0 and 102.0 kg/m$^2$; (3) potassium source (2.5 wt %) in a sandstone ore body covered with biomass densities of 0, 10.2, 20.4, 51.0 and 102.0 kg/m$^2$; (4) constant airborne source with height for no inversion and for inversion layer heights of 65.22, 260.32 and 458.43 m; (5) exponentially decreasing airborne source for no inversion and inversion layer heights of 65.22, 260.32 and 458.43 m; (6) 3.2 ppM uranium source in overburden layers of 10.266, 17.110, 26.399 and 32.509 cm thick; (7) 12 ppM thorium source in overburden layers of 10.266, 17.110, 26.399 and 32.509 cm; (8) 2.5 wt % of potassium in overburden layers of 10.266, 17.110, 26.399 and 32.509 cm thick; and (9) 3.2 ppM, 200 ppM, and 800 ppM uranium source in sandstone orebody covered with overburden thicknesses of 10.266, 17.110, 26.399 and 32.509 cm. Gamma-ray emission from the decay of natural uranium, thorium, radon, and potassium are given in a 45-energy group structure applicable to the energy windows used to map the potential uranium ore reserves.

21640 **(GJBX—144(81)) Preliminary study of the transport and distribution of radium, radon and their alpha-emitting daughters using nuclear emulsions and polonium-210. Final report.** Stieff, L.R.; Balkissoon, I.L.; Barbera, F.M. (Stieff Research and Development Co., Inc., Kensington, MD (USA)). Mar 1981. Contract AC13-GJ01664. 168p. NTIS, PC A08/MF A01.

Semi-quantitative Po-210 measurements were made on near surface soil samples near known uranium ore deposits and on closely related diamond drill cores. The physical distribution of uranium and some of its alpha emitting daughter products in these samples was studied qualitatively using alpha sensitive nuclear emulsions. These nuclear emulsion plates suggest that U-238 and its long lived daughters U-234, Th-230 and Ra-226, deposit on grain surfaces in very low concentrations (U-238 in sub picogram amounts). Concentrations of alpha activity usually associated with discrete uranium were not observed. On the basis of alpha star counts in the emulsion, Ra-226 appears to be more mobile than Rn-222. Measurements of Po-210 provide an indirect means of estimating the number of Rn-222 atoms that have decayed over the last 80 to 100 years. Many Po-210 highs have been observed in the Red Desert (Wyoming) cores; some directly associated with uranium mineralization. Evidence was not found for the predicted Po-210 concentration gradient produced by the decay of mobile, unsupported Rn-222. The Po-210 analyses and microscopic studies suggest that observed Rn-222 and Po-210 surface anomalies may be associated with widely dispersed very low concentrations of Ra-226 or its longer

lived parents including uranium which surround the ore as halos or as weak zones of uranium mineralization. The Po-210 sub-surface soil anomaly map from this study was also compared with earlier surface anomaly maps from the same area based on helium, radon by Track-Etch and uranium surveys. Selective chemical leaching experiments undertaken in an effort to enhance the mobile Ra-222/Po-210 signal were not successful.

21641 **(GJBX—145(81)) Hydrogeochemical and stream sediment reconnaissance basic data for Scottsbluff NTMS Quadrangle, Nebraska and Colorado.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 28 Feb 1981. Contract W-7405-ENG-26. 302p. (K/UR—147). NTIS, PC E10/MF $3.50.

Includes 2 sheets of 48 reduction microfiche.

Results of a reconnaissance geochemical survey of the Scottsbluff Quadrangle are reported. Field and laboratory data are presented for 567 groundwater and 402 stream sediment samples. Statistical distributions and symbol plots for uranium and possible uranium-related variables are enclosed. A generalized geologic map and a producing horizon map for the survey area are provided. Pertinent geologic factors which may be of significance in evaluating the potential for uranium mineralization are briefly discussed. Groundwater data indicate that uranium concentrations above the 85th percentile occur primarily in the northwestern corner of the quadrangle, and that uranium in groundwater is associated with high values for specific conductance, boron, calcium, lithium, magnesium, sodium, strontium, sulfate, and total alkalinity. Water in this area is produced primarily from the White River Group. Weighted sum models for groundwater of the Scottsbluff Quadrangle delineate areas in the northwestern section in which uranium is associated with variables deemed favorable for economic mineralization. Stream sediment data indicate that uranium values above the 85th percentile occur in three areas in the western portion of the quadrangle and that soluble uranium is associated with high values for uranium by neutron activation, iron, lithium, magnesium, manganese, phosphorus, scandium, yttrium, and zinc. Sediment with high soluble uranium concentrations was derived primarily from the Hemingford, Arikaree, and White River Groups.

21642 **Principal components analysis as a tool for interpreting NURE aerial radiometric survey data.** Pirkle, F.L.; Campbell, K.; Wecksung, G.W. (Bendix Field Engineering Corp., Grand Junction, CO). *Journal of Geology ;* **88**: No. 1, 57-67(Jan 1980).

Since 1974 the Grand Junction, Colorado, Office, US Department of Energy, through its National Uranium Resource Evaluation (NURE) program, has been conducting aerial surveys over various portions of the United States. The multivariate structure of the data suggests that statistical techniques of multivariate analysis are appropriate. Principal components analysis provides immediate insight into the structure of multivariate data and was applied to aerial data collected in the Lubbock and Plainview NTMS quadrangles. The components appear to lend themselves to an interpretation which sheds light on the geological history of the study area and aid in the identification of areas favorable to uranium deposition. The use of this technique may result in different conclusions in various geologic environments; however, it will always allow insight into the structure of the aerial radiometric data.

## 0504 Feed Processing

*REFER ALSO TO CITATION(S) 21694*

## 0505 Enrichment

*REFER ALSO TO CITATION(S) 21699, 22237, 22436*

21643 **(ORNL-tr—4735) Photoexcitation system.** (Oak Ridge National Lab., TN (USA)). 22 Jun 1979. Translation of . Netherlands Patent Application 862,409. 19p. NTIS, PC A02/MF A01.

A photoexcitation system is described for isotope separation, particularly of uranium isotopes. Ionization is achieved in such a way that the isotope separation is improved for the same amount of energy. The photoexcitation is brought about in two or more energy steps via a highly charged state from which the ionization is attained, laser radiation being used. A frequency variation is produced which brings about the second transition. Adjacent mode frequencies are used which differ from each other by approximately 100 MHz.

## 0507 Fuels Production And Properties

*REFER ALSO TO CITATION(S) 21706, 21707, 21708, 22275, 22297, 22299, 22300, 22301, 22302*

21644 (CONF-8005107—, pp 58-69) **Probable leaching mechanisms for spent fuel.** Wang, R.; Katayama, Y.B. (Pacific Northwest Lab., Richland, WA). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

At the Pacific Northwest Laboratory, researchers in the Waste/Rock Interaction Technology Program are studying spent fuel as a possible waste form for the Office of Nuclear Waste Isolation. This paper presents probable leaching mechanisms for spent fuel and discusses current progress in identifying and understanding the leaching process. During the past year, experiments were begun to study the complex leaching mechanism of spent fuel. The initial work in this investigation was done with $UO_2$, which provided the most information possible on the behavior of the spent-fuel matrix without encountering the very high radiation levels associated with spent fuel. Both single-crystal and polycrystalline $UO_2$ samples were used for this study, and techniques applicable to remote experimentation in a hot cell are being developed. The effects of radiation are being studied in terms of radiolysis of water and surface activation of the $UO_2$. Dissolution behavior and kinetics of $UO_2$ were also investigated by electrochemical measurement techniques. These data will be correlated with those acquired when spent fuel is tested in a hot cell. Oxidation effects represent a major area of concern in evaluating the stability of spent fuel. Dissolution of $UO_2$ is greatly increased in an oxidizing solution because the dissolution is then controlled by the formation of hexavalent uranium. In solutions containing very low oxygen levels (i.e., reducing solutions), oxidation-induced dissolution may be possible via a previously oxidized surface, through exposure to air during storage, or by local oxidants such as $O_2$ and $H_2O_2$ produced from radiolysis of water and radiation-activated $UO_2$ surfaces. The effects of oxidation not only increase the dissolution rate, but could lead to the disintegration of spent fuel into fine fragments.

21645 **Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species.** Green, D.W. (Argonne Natl Lab, Ill). *Journal of Nuclear Materials ;* **88**: No. 1, 51-63(Jan 1980).

The author examines the relationship between the calculated free-energy functions and the measured free energies of formation and their uncertainties for the cases of known U, Pu, and Th oxide vapor species. The methods derived in this paper can be applied, whenever sufficient spectroscopic data are available, to ensure a consistent set of thermodynamic data. 30 refs. cC 25 0 93 8o ltdhees tcoonn-fsohremaa.tMi.

## 0508 Spent Fuels Reprocessing

*REFER ALSO TO CITATION(S) 21700, 21712, 21715, 22027, 22333, 22349*

21646 **System for nondestructive assay of spent fuel subassemblies--comparison of calcuations and measurements.** Ragan, G.L.; Ricker, C.W.; Chiles, M.M.; Ingersoll, D.T.; Slaughter, G.G.; Williams, L.R. (Oak Ridge Natl Lab, Tenn). *National Bureau of Standards (U.S.). Special Publication ;* 447-456(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

A nondestructive assay system was developed for determining the total fissile content of spent fuel subassemblies at the head end of a reprocessing plant. The system can perform an assay in 20

min with an uncertainty of less than 5%. Antimony-beryllium neutrons (23 keV) interogate the subassemblies, and proton recoil counters detect the resulting fission neutrons. Pulse-height discrimination differentiates between the low-energy interrogation neutrons and the higher-energy fission neutrons. 5 refs.

**21647 Nondestructive, energy-dispersive, x-ray fluorescence analysis of product stream concentrations from reprocessed nuclear fuels.** Camp, D.C.; Ruhter, W.D. (Lawrence Livermore Lab, Calif). *National Bureau of Standards (U.S.), Special Publication ;* 584-601(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The experimental results discussed above have demonstrated that energy dispersive x-ray fluorescence analysis (EDXRFA) can determine the concentration of uranium, plutonium, or mixed uranium-plutonium solutions in flowing or static streams. The EDXRFA technique is nondestructive and can be adapted directly to pipelines in facilities that have process or product streams containing these actinide elements. The technique can also be used to make off-line measurements. 6 refs.

## 0509 Transport And Storage

*REFER ALSO TO CITATION(S) 21677, 21682, 21683*

**21648 (DOE/NV/00597—5) Spent fuel dry storage technology development: thermal evaluation of isolated drywells containing spent fuel (1 kW PWR spent fuel assembly).** Unterzuber, R.; Wright, J.B. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). Sep 1980. Contract AC08-76NV00597. 215p. NTIS, PC A10/MF A01.

A spent fuel Isolated Drywell Test was conducted at the Engine-Maintenance, Assembly and Disassembly (E-MAD) facility on the Nevada Test Site. Two PWR spent fuel assemblies having a decay heat level of approximately 1.1 kW were encapsulated inside the E-MAD Hot Bay and placed in instrumented near-surface drywell storage cells. Temperatures from the two isolated drywells and the adjacent soil have been recorded throughout the 19 month Isolated Drywell Test. Canister and drywell liner temperatures reached their peak values (254°F and 203°F, respectively) during August 1979. Thereafter, all temperatures decreased and showed a cycling pattern which responded to seasonal atmospheric temperature changes. A computer model was utilized to predict the thermal response of the drywell. Computer predictions of the drywell temperatures and the temperatures of the surrounding soil are presented and show good agreement with the test data.

**21649 (ONWI—189) Discount rate in the spent fuel storage and disposal fee.** Forster, J.D.; Cohen, S. (TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.). Apr 1980. Contract AC06-76RL01830. 64p. NTIS, PC A04/MF A01.

After introducing the financial analyses, discount rates, and interest rates involved, the study discusses existing government guidelines for establishing charges for any service provided by the government to be paid by users of those services. Three current government user charges are analyzed including specifically their interest rate policies and how these charges provide precedent for the spent fuel acceptance and disposal fee: uranium enrichment services, the sale of electric power, and the delivery of experiments to orbit by the NASA Space Shuttle. The current DOE policy regarding this storage and disposal fee is stated and discussed. Features of this policy include: the full government cost is borne by users of the services provided; the fee is established and due in full at the time of spent fuel delivery; and the fee is adjusted when spent fuel is transferred from the AFR to the repository. Four evaluation criteria for use in analyzing the applications of discount rates in the spent fuel acceptance fee calculation are discussed. Three outstanding issues are discussed.

**21650 (SAND—81-0605C) Analysis of protection requirements for away-from-reactor spent fuel storage facilities.** Winblad, A.E.; Dean, F.F. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 10p. (CONF-810706—2). NTIS, PC A02/MF A01.

From Institute of Nuclear Materials Management conference; San Francisco, CA, USA (13 Jul 1981).

An approach that is useful in developing protection requirements for an away-from-reactor spent fuel storage facility is described. An analysis of the consequences of causing radiological dispersal of spent fuel using explosives and other means is investigated for various material locations. Potential sabotage targets and adversary activities are considered. Using the consequence and target analysis as a point of departure, requirements for a typical physical protection system that meet applicable governmental regulations and that counter postulated threats are identified. Some protection elements that can be used to meet these requirements are discussed.

## 0510 Marketing And Economics

**21651 (MIT-EL—80-014) International uranium market.** Neff, T.L.; Jacoby, H.D. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1980. Contract AM01-76EI02295. 194p. NTIS, PC A09/MF A01.

Discussed in this report are 1) how one might think about uranium demand, resources and supply, 2) how producers and consumers see the market and are likely to behave, including specifics about export and import commitments, and 3) how these actors are brought together in the international market. The general conclusion is that much of current anxiety about future uranium supply results primarily from a brief but difficult period in the mid- to late-1970's; and that current conditions and trends are favorable (at least to consumers) that there is now little basis for concern. Inventories contractual positions and producer commitments--when compared with realistic (or even unrealistic) demand estimates--imply a buyer's market for at least the next decade. The result will be considerable increases in market flexibility and resilience to shock, and real prices that are low relative to those of the past few years. There is a need to reconsider assumptions about desired directions of technological development, for many current programs were planned in an era of pessimism about uranium supply and process. Similar questions must be raided about nonproliferation policies that depend on some level of control of fuel supplies by the industrial nations. With a soft and more diversified uranium market, leverage that may have existed in the past is rapidly being eroded. Finally, as world prices turn soft, there may be significant problems created for U.S. uranium producers, who have relatively high costs in relation to several large-scale foreign suppliers.

## 0520 Waste Management

*REFER ALSO TO CITATION(S) 21619, 21644, 21648, 21649, 21692, 21702, 22294, 22333, 22336, 22337, 22357, 22724, 22725, 22731, 22733*

**21652** (CONF-791016—, pp 7-19) **Component effects in mixture experiments.** Piepel, G.F. (Battelle Pacific Northwest Labs., Richland, WA). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

In a mixture experiment, the response to a mixture of q components is a function of the proportions $x_1, x_2, ..., x/sub\ q/$ of components in the mixture. Experimental regions for mixture experiments are often defined by constraints on the proportions of the components forming the mixture. The usual (orthogonal direction) definition of a factor effect does not apply because of the dependence imposed by the mixture restriction, $/sup\ q/\Sigma/sub\ i=1/\ x/sub\ i/ = 1$. A direction within the experimental region in which to compute a mixture component effect is presented and compared to previously suggested directions. This new direction has none of the inadequacies or errors of previous suggestions while having a more meaningful interpretation. The distinction between partial and total effects is made. The uses of partial and total effects (computed

using the new direction) in modification and interpretation of mixture response prediction equations are considered. The suggestions of the paper are illustrated in an example from a glass development study in a waste vitrification program. 5 figures, 3 tables.

**21653 (CONF-8005107—) Alternate nuclear waste forms and interactions in geologic media.** Boatner, L.A.; Battle, G.C. Jr. (eds.). (Oak Ridge National Lab., TN (USA); Department of Energy, Washington, DC (USA). Office of Energy Research). Apr 1981. 396p. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

The primary purposes of the conference on Alternate Nuclear Waste Forms and Interactions in Geologic Media were: First, to provide an opportunity for a review of the status of the research on some of the candidate alternative waste forms; second, to provide an opportunity for comparing the characteristics of alternate waste forms to those of glasses; and third, to stimulate increased interactions between those research groups that were engaged in a more basic approach to characterizing waste forms and those who were concerned with more applied aspects such as the processing of these materials. The motivating philosophy behind this third purpose of the conference was based on the idea that by operating from the soundest possible fundamental base for any of the candidate waste forms, hopefully any future unpleasant surprise - such as that alluded to earlier in the case of glass waste forms - could be avoided. Separate abstracts have been prepared for individual papers for inclusion in the Energy Data Base.

**21654** (CONF-8005107—, pp 4-24) **Application of SYNROC to high-level defense wastes.** Tewhey, J.D.; Hoenig, C.L.; Newkirk, H.W.; Rozsa, R.B.; Coles, D.G.; Ryerson, F.J. (Lawrence Livermore National Lab., CA). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

The SYNROC method for immobilization of high-level nuclear reactor wastes is currently being applied to US defense wastes in tank storage at Savannah River, South Carolina. The minerals zirconolite, perovskite, and hollandite are used in SYNROC D formulations to immobilize fission products and actinides that comprise up to 10% of defense waste sludges and coexisting solutions. Additional phase in SYNROC D are nepheline, the host phase for sodium; and spinel, the host for excess aluminum and iron. Up to 70 wt % of calcined sludge can be incorporated with 30 wt % of SYNROC additives to produce a waste form consisting of 10% nepheline, 30% spinel, and approximately 20% each of the radioactive waste-bearing phases. Urea coprecipitation and spray drying/calcining methods have been used in the laboratory to produce homogeneous, reactive ceramic powders. Hot pressing and sintering at temperatures from 1000 to 1100°C result in waste form products with greater than 97% of theoretical density. Hot isostatic pressing has recently been implemented as a processing alternative. Characterization of waste-form mineralogy has been done by means of XRD, SEM, and electron microprobe. Leaching of SYNROC D samples is currently being carried out. Assessment of radiation damage effects and physical properties of SYNROC D will commence in FY81.

**21655** (CONF-8005107—, pp 81-99) **Radiation damage in natural materials: implications for radioactive waste forms.** Ewing, R.C. (Univ. of New Mexico, Albuquerque). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

The long-term effect of radiation damage on waste forms, either crystalline or glass, is a factor in the evaluation of the integrity of waste disposal mediums. Natural analogs, such as metamict minerals, provide one approach for the evaluaton of radiation damage effects that might be observed in crystalline waste forms, such as supercalcine or synroc. Metamict minerals are a special class of amorphous materials which were initially crystalline. Although the mechanism for the loss of crystallinity in these minerals (mostly actinide-containing oxides and silicates) is not clearly understood, damage caused by alpha particles and recoil nuclei is critical to the metamictization process. The study of metamict minerals allows the evaluation of long-term radiation damage effects, particularly changes in physical and chemical properties such as microfracturing, hydrothermal alteration, and solubility. In addition, structures susceptible to metamictization share some common properties: (1) complex compositions; (2) some degree of covalent bonding, instead of being ionic close-packed MO/sub x/ structures; and (3) channels or interstitial voids which may accommodate displaced atoms or absorbed water. On the basis of these empirical criteria, minerals such as pollucite, sodalite, nepheline and leucite warrant careful scrutiny as potential waste form phases. Phases with the monazite or fluorite structures are excellent candidates.

**21656** (CONF-8005107—, pp 144-169) **Review of research on analogs of monazite for the isolation of actinide wastes.** Abraham, M.M.; Boatner, L.A.; Beall, G.W.; Finch, C.B.; Floran, R.J.; Huray, P.G.; Rappaz, M. (Oak Ridge National Lab., TN). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

The lanthanide orthophosphates ($LnPO_4$) are being investigated as a means of primary containment for high-level actinide wastes. Lanthanum orthophosphate and orthophosphates of the first half of the lanthanide transition series (i.e., Ce through Gd) are analogs of the mineral monazite. The known long-term ($10^9$ yr) stability of this mineral under a variety of geological conditions, its ability to incorporate the naturally occurring actinides Th and U, and its apparent resistance to $\alpha$-particle-induced radiation damage indicate that the analogous lanthanide orthophosphates could well represent ideal hosts for the immobilization of transuranic actinide wastes. A flux technique has been used to grow single crystals of every lanthanide orthophosphate (except $PmPO_4$) as well as $ScPO_4$ and $YPO_4$, and these crystals have been employed in a variety of x-ray, electron paramagnetic resonance, Moessbauer, radiation damage, and chemical stability studied. Single crystals of uranium-doped $LaPO_4$ were grown from an oxide mixture containing 10 wt % $^{238}UO_2$. The optical absorption spectra show that the uranium impurity is present in these crystals in the tetravalent state. Other actinides, $^{241}Am_2O_3$, $^{242}Pu_2O_3$ and $^{246}Cm_2O_3$, have been studied also. Leach tests of the orthophosphate crystals resulted in IAEA leach indices that were smaller than those reported for grouts or borosilicate glasses. The method of precipitation in molten urea does represent a promising technique for the practical synthesis of actinide-containing rare-earth orthophosphates. Examination of suitably doped precipitated powders using electron paramagnetic resonance has shown that rare-earth impurities occupy identical sites in both the single crystals and the urea-precipitated material.

**21657** (CONF-8005107—, pp 170-184) **Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms.** Rappaz, M.; Boatner, L.A.; Abraham, M.M. (Oak Ridge National Lab., TN). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

Electron paramagnetic resonance (EPR) spectroscopy is currently a well established technique that is frequently applied in materials science to the study of paramagnetic impurities and defects in solids. The EPR spectrum of a paramagnetic impurity (e.g. $Cm^{3+}$, $Am^{2+}$, $Gd^{3+}$, $Fe^{3+}$ ...) in a dielectric host crystal reflects the crystalline electric field created by the neighboring ions which surround the impurity. Therefore, the number of EPR transitions observed and their positions as a function of the strength and relative orientation of the applied magnetic field can be used to determine the valence state of the paramagnetic impurity, and the site(s) occupied by the impurity and can provide information regarding the local crystal structure. The intensity of the EPR transitions for a given impurity ion is directly proportional to the number of such paramagnetic ions present in the sample, and this fact can be used to obtain information regarding the phase diagram of mixed host-impurity systems. For example, a comparison of the EPR spectra due to $Gd^{3+}$ and $Fe^{3+}$ ions in $LuPO_4$ has shown that $Fe^{3+}$ impurities are not incorporated into $LuPO_4$ as easily as $Gd^{3+}$. Unlike the broadening of x-ray powder diffraction peaks, which primarily results from effects due to the size of crystallites that compose the powder, the linewidths of EPR transitions are mainly affected by the number of defects or impurities present in the structure. Accordingly, paramagnetic impurities can be used to monitor defects,

and strains, such as those due to the presence of impurities of different ionic size or valence, or to radiation damage produced by actinide dopants.

**21658** (CONF-8005107—, pp 185-193) **Hot and cold pressing of (La,Ce)$PO_4$-based nuclear waste forms.** Floran, R.J.; Rappaz, M.; Abraham, M.M.; Boatner, L.A. (Oak Ridge National Lab., TN). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

Synthetic analogs of the mineral monazite [(Ce,La,Ca,Th,U)(P,Si)$O_4$] are promising host phases for the isolation of actinide wastes. In the present investigation, the optimal conditions necessary to form high-density, simulated waste pellets from calcined $LaPO_4$ and $CePO_4$ powders have been examined. Pellets that are close to the theoretical density are necessary in order to minimize porosity and hence potential avenues along which fluid/waste interactions can take place. Calcined powders prepared by a urea precipitation process were cold pressed and hot pressed under a range of controlled conditions to form coherent, cylindrical pellets. Changes in density were examined as a function of pressure, temperature and duration of sintering. For cold-pressed pellets, a significant increase in density occurs during sintering between 1000°C and 1100°C. This increase is correlated with substantial grain coarsening of the pellet microstructure. A comparison of cold and hot pressing techniques suggests that, only after sintering, does the density of cold-pressed pellets approach (but not equal) that of the hot-pressed pellets. Densities >90% of the theoretical value of 5.11 g/cm$^3$ are easily attainable by hot pressing without sintering. The significance of density differences on pellet stability will be investigated in future leaching studies. The apparent advantages of the higher densities achieved by hot pressing must be weighed against the increased technological/engineering complexities involved when working at sustained high temperatures in a remote environment. Thus the cold pressing technique may ultimately prove more practical for large-scale commercial operations.

**21659** (CONF-8005107—, pp 194-216) **Survey of concrete waste forms.** Moore, J.G. (Oak Ridge National Lab., TN). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

The incorporation of radioactive waste in cement has been widely studied for many years. It has been routinely used at nuclear research and production sites for some types of nuclear waste for almost three decades and at power reactor plants for nearly two decades. Cement has many favorable characteristics that have contributed to its popularity. It is a readily available material and has not required complex and/or expensive equipment to solidify radioactive waste. The resulting solid products are noncombustible, strong, radiation resistant, and have reasonable chemical and thermal stability. As knowledge increased on the possible dangers from radioactive waste, requirements for waste fixation became more stringent. A brief survey of some of the research efforts used to extend and improve cementitious waste hosts to meet these requirements is given in this paper. Selected data are presented from the rather extensive study of the applicability of concrete as a waste form for Savannah River defense waste and the use of polymer impregnation to reduce the leachability and improve the durability of such waste forms. Hot-pressed concretes that were developed as prospective host solids for high-level wastes are described. Highlights are given from two decades of research on cementitious waste forms at Oak Ridge National Laboratory. The development of the hydrofracture process for the disposal of all locally generated radioactive waste led to a process for the disposal of I-129 and to the current research on the German in-situ solidification process for medium-level waste and the Oak Ridge FUETAP process for all classes of waste including commercial and defense high-level wastes. Finally, some of the more recent ORNL concepts are presented for the use of cement in the disposal of inorganic and biological sludges, waste inorganic salts, trash, and krypton.

**21660** (CONF-8005107—, pp 242-247) **Sol-gel technology applied to alternative high-level waste forms development.** Angelini, P.; Stinton, D.P.; Vavruska, J.S.; Caputo, A.J.; Lackey, W.J. (Oak Ridge National Lab., TN). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

Sol-gel technology appears applicable to waste solidification. It is attractive for remote operation, and a variety of waste compositions and forms can be produced. Spheres and pellets of gel-derived Synroc waste forms were produced. Spheres of the Synroc-B type were coated with pyrolytic carbon and silicon carbide. Partitioning of actinides in Synroc-B was experimentally determined.

**21661** (CONF-8005107—, pp 248-261) **Chemically vapor deposited coatings for multibarrier containment of nuclear wastes.** Rusin, J.M.; (Pacific Northwest Lab., Richland, WA); Shade, J.W.; Kidd, R.W.; Browning, M.F. Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

Chemical vapor deposition (CVD) was selected as a feasible method to coat ceramic cores, since the technology has previously been demonstrated for high-temperature gas-cooled reactor (HTGR) fuel particles. CVD coatings, including SiC, PyC (pyrolytic carbon), $SiO_2$, and $Al_2O_3$ were studied. This paper will discuss the development and characterization of PyC and $Al_2O_3$ CVD coatings on supercalcine cores. Coatings were applied to 2 mm particles in either fluidized or vibrating beds. The PyC coating was deposited in a fluidized bed with $ZrO_2$ diluent from $C_2H_2$ at temperatures between 1100 and 1200°C. The $Al_2O_3$ coatings were deposited in a vibrated bed by a two-stage process to minimize loss of PyC during the overcoating operation. This process involved applying 10 μm of $Al_2O_3$ using water vapor hydrolysis of $AlCl_3$ and then switching to the more surface-controlled hydrolysis via the $H_2 + CO_2$ reaction ($3CO_2 + 3H_2 + 2AlCl_3 = Al_2O_3 + 6HCl + 3CO$). Typically, 50 to 80 μm $Al_2O_3$ coatings were applied over 30 to 40 μm PyC coatings. The coatings were evaluated by metallographic examination, PyC oxidation tests, and leach resistance. After air oxidation for 100 hours at 750°C, the duplex PyC/$Al_2O_3$ coated particles exhibited a weight loss of 0.01 percent. Leach resistance is being determined for temperatures from 50 to 150°C in various solutions. Typical results are given for selected ions. The leach resistance of supercalcine cores is significantly improved by the application of PyC and/or $Al_2O_3$ coatings.

**21662** (CONF-8005107—, pp 287-296) **Influence of waste solid on nuclide dispersal.** Seitz, M.G.; Steindler, M.J. (Argonne National Lab., IL). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

The method most often considered for permanent disposal of radioactive waste is to incorporate the waste into a solid, which is then placed in a geologic formation. The solid is made of waste and nonradioactive additives, with the formulation selected to produce a durable solid that will minimize the potential for dispersal of the radionuclides. Leach rates of radionuclides incorporated in the solid waste indicate the quantity of radioactivity available for dispersal at any time; but leach rates of stable constituents can be just as important to radionuclide dispersal by groundwater. The constituents of the solid will perturb the chemical character of the groundwater and, thereby, profoundly affect the interaction of radionuclides with the geologic medium. An explicit example of how the solid waste can affect radionuclide dispersal is illustrated by the results of experiments that measure cesium adsorption in the presence of rubidium. The experiments were performed with granulated oolitic limestone that absorbed cesium from groundwater solutions to which various concentrations of stable rubidium chloride had been added. The results are expressed as partition coefficients. Large coefficients indicate strong adsorption by the rock and, hence, slow migration. The partition coefficient for cesium decreases as the rubidium concentration in solution is increased. Because the coeficient for cesium depends on the amount of rubidium in solution, it will depend on the leach rate of rubidium from the solid. Rubidium has no radionuclides of concern for long-term isolation of nuclear waste, so its leach rate from a waste solid is rarely ever reported.

**21663** (CONF-8005107—, pp 297-316) **High level waste fixation in cermet form.** Kobisk, E.H.; Aaron, W.S.; Quinby, T.C.; Ramey, D.W. (Oak Ridge National Lab., TN). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

Commercial and defense high level waste fixation in cermet form is being studied by personnel of the Isotopes Research Materials Laboratory, Solid State Division (ORNL). As a corollary to earlier research and development in forming high density ceramic and cermet rods, disks, and other shapes using separated isotopes, similar chemical and physical processing methods have been applied to synthetic and real waste fixation. Generally, experimental products resulting from this approach have shown physical and chemical characteristics which are deemed suitable for long-term storage, shipping, corrosive environments, high temperature environments, high waste loading, decay heat dissipation, and radiation damage. Although leach tests are not conclusive, what little comparative data are available show cermet to withstand hydrothermal conditions in water and brine solutions. The Soxhlet leach test, using radioactive cesium as a tracer, showed that leaching of cermet was about X100 less than that of 78 to 68 glass. Using essentially uncooled, untreated waste, cermet fixation was found to accommodate up to 75% waste loading and yet, because of its high thermal conductivity, a monolith of 0.6 m diameter and 3.3 m-length would have only a maximum centerline temperature of 29 K above the ambient value.

**21664** (CONF-8005107—, pp 331-354) **Review of glass ceramic waste forms.** Rusin, J.M. (Pacific Northwest Lab., Richland, WA). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

Glass ceramics are being considered for the immobilization of nuclear wastes to obtain a waste form with improved properties relative to glasses. Improved impact resistance, decreased thermal expansion, and increased leach resistance are possible. In addition to improved properties, the spontaneous devitrification exhibited in some waste-containing glasses can be avoided by the controlled crystallization after melting in the glass-ceramic process. The majority of the glass-ceramic development for nuclear wastes has been conducted at the Hahn-Meitner Institute (HMI) in Germany. Two of their products, a celsian-based ($BaAl_2Si_2O_8$) and a fresnoite-based ($Ba_2TiSi_2O_8$) glass ceramic, have been studied at Pacific Northwest Laboratory (PNL). A basalt-based glass ceramic primarily containing diopsidic augite ($CaMgSi_2O_6$) has been developed at PNL. This glass ceramic is of interest since it would be in near equilibrium with a basalt repository. Studies at the Power Reactor and Nuclear Fuel Development Corporation (PNC) in Japan have favored a glass-ceramic product based upon diopside ($CaMgSi_2O_6$). Compositions, processing conditions, and product characterization of typical commercial and nuclear waste glass ceramics are discussed. In general, glass-ceramic waste forms can offer improved strength and decreased thermal expansion. Due to typcially large residual glass phases of up to 50%, there may be little improvement in leach resistance.

**21665** **(DOE/NWTS—33(1)) NWTS program criteria for mined geologic disposal of nuclear waste: program objectives, functional requirements, and system performance criteria.** (Battelle Memorial Inst., Columbus, OH (USA)). Apr 1981. Contract AC06-76RL01830. 48p. NTIS, PC A05/MF A01.

At the present time, final repository criteria have not been issued by the responsible agencies. This document describes general objectives, requirements, and criteria that the DOE intends to apply in the interim to the National Waste Terminal Storage (NWTS) Program. These objectives, requirements, and criteria have been developed on the basis of DOE's analysis of what is needed to achieve the National objective of safe waste disposal in an environmentally acceptable and economic manner and are expected to be consistent with anticipated regulatory standards. The qualitative statements in this document address the broad issues of public and occupational health and safety, institutional acceptability, engineering feasibility, and economic considerations. A comprehensive set of criteria, general and project specific, of which these are a part, will constitute a portion of the technical basis for preparation and submittal by the DOE of formal documents to support future license applications for nuclear waste repositories.

**21666** **Volatility of some potential high-level radioactive waste forms.** Gray, W.J. (Battelle Pacific Northwest Labs, Wash). *Radioactive Waste Management (New York)* ; **1**: No. 2, 147-169(Sep 1980).

Volatilities of seven simulated high level radioactive waste glasses, two supercalcines, and one regular calcine in the range 1073°K to 1573°K were determined. Rubidium, cesium, ruthenium, molybdenum, and tellurium were found in the vapor from all materials. Sodium, potassium, and boron were vaporized from materials that contained them. There was a strong correlation between viscosity of the glasses and their volatility. Heats of vaporization of all volatile elements from the glasses were roughly the same, suggesting that a single mechanism controls the vaporization rate of all elements. The two supercalcines were less volatile than any of the glasses. Cesium and molybdenum were the most volatile elements in the supercalcines. Volatility of all the materials studied was significant only at temperatures above 1000°K, but was negligible at waste storage temperatures.

**21667** **(DOE/TIC—1021731) Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis. Final report.** Cummings, R.D.; Burness, H.S.; Norton, R.D. (New Mexico Univ., Albuquerque (USA). Dept. of Economics). Apr 1981. 371p. (EMD—2-67-1139). NTIS, PC A16/MF A01.

This document is a final report for research conducted concerning the socio-economic impacts in the State of New Mexico that might attend the construction and operation of the proposed Waste Isolation Pilot Plant (WIPP). The proposed site for the WIPP, known as the Los Medanos site, is in Southeastern New Mexico's Eddy County, some 25 miles east of Carlsbad, New Mexico and some 40 miles from Hobbs, New Mexico, in adjacent Lea County. The purpose as set out in the US Department of Energy's environmental impact statements is for storage of TRU waste from the US defense program and the construction of a research and development area for experiments concerning the isolation of all types of nuclear waste in salt. The intended purpose of the study is to identify, measure (when possible) and assess the range of potential socio-economic impacts in the State that may be attributable to the WIPP. Every effort has been made by the authors to approach this task in an objective manner. In efforts to provide an objective analysis of the WIPP, however, particular attention was required in providing a comprehensive review of potential impacts. This means that however unlikely an impact might seem, the authors have purposely avoided pre-judging the potential magnitude of the impact and have applied their best efforts to measure it. On the other hnd, this study is not intended to provide a definitive calculation regarding the net balance of WIPP-related benefits and costs. To help ensure objectivity, two advisory boards, Technical Advisory Board and Public Advisory Board, were formed at the outset of the project for the purpose of providing periodic reviews of research efforts.

**21668** **(DOE/TIC—1022080) Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis.** Cummings, R.D.; Burness, H.S.; Norton, R.D. (New Mexico Univ., Albuquerque (USA). Dept. of Economics). Apr 1981. 120p. (EMD—2-67-1139(WP)). NTIS, PC A06/MF A01.

In the process of preparing a socio-economic study of WIPP-related impacts in the State of New Mexico, the authors considered a wide range of potential socio-economic impacts. The state of the art for deriving quantitative measures for many of these impacts, however, is at a relatively infant stage. While methods and data for measuring such things as increases in crime rates and local inflation are primitive at this point in time, considerable time was spent by the authors in investigating these methods inasmuch as it seemed highly probably that the socio-economic study would have to be updated if, and when, the WIPP was ultimately approved. This report represents a collection of working papers which describe the methods examined by the authors in their efforts to quantify some of the more important impacts which might be associated with the WIPP. Methods used in the study for estimating popula-

tion and employment effects are sketched in Working Paper A, along with a description of the author's efforts to derive statistical estimates for changes in baseline labor force participation rates. Diversification impacts are considered in Working Paper C, and a statistical approach to measuring impacts on municipal, county, and services is described in Working Papers B and D. Local inflation and crime effects are described in Working Papers E and F, and the compensation issue is treated in Working Paper G. The bulk of statistical methods described in these Working Papers was not used in the socio-economic study, primarily due to the lack of credible data required for this use. The intended purpose for presenting these papers is solely that of suggesting analytical techniques for impact measurements which might be useful for future studies of this kind when more appropriate data might be available.

21669 **(DP-MS—80-123) Design and operation of a prototype incinerator for beta-gamma waste.** Farber, M.G.; Hootman, H.E.; Becker, G.W. Jr.; Makohon, P.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 23p. (CONF-810606—35). NTIS, PC A02/MF A01.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

A full-scale test incinerator has been built at the Savannah River Laboratory to provide a design basis for a radioactive facility that will burn low-level beta-gamma contaminated waste. The processing steps include waste feed loading, incineration, ash residue packaging, and off-gas cleanup. Both solid and liquid waste will be incinerated during the test program. The components of the solid waste are cellulose, latex, polyethylene, and PVC; the solvent is composed of n-paraffin and TBP. A research program will confirm the feasibility of the design and determine the operating parameters.

21670 **(DP-MS—81-8) Combustion-rate predictions for controlled-air incinerators.** Orloff, D.I.; Hootman, H.E. (South Carolina Univ., Columbia (USA). Coll. of Engineering; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 22p. (CONF-810551—1). NTIS, PC A02/MF A01.

From ASME/USEPA hazardous waste incineration conference; Williamsburg, VA, USA (27 May 1981).

The objective of this study was to measure and model combustion rates of typical radioactive waste materials as a function of incinerator operating conditions. The analytical model developed in this work has been incorporated into a waste-burning transient code. The code predicts instantaneous air requirement, heat energy release, and waste package burning time as a function of waste type, package size, combustion chamber size, and temperature. The computed combustion rates and burning times approximate measured values in pilot (0.5 kg/h) and full-scale (5 kg/h) alpha incinerators for a wide variety of typical waste materials and waste mixtures.

21671 **(ENICO—1087) Design and installation of a pilot-plant to vitrify ICPP-simulated calcined high-level waste.** Gombert, D. II; Chamberlain, D.B.; Colton, E.L. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). May 1981. Contract AC07-79ID01675. 59p. NTIS, PC A04/MF A01.

A pilot-plant has been constructed to test the vitrification of simulated high-level calcined waste. Specifications of major system components including the glass melter, the feed system, the off-gas system, the canister handling system, and instrumentation are presented. Instructions for startup, shutdown, and safety procedures are outlined in appendices.

21672 **(LA-UR—81-1385) Low-level-waste-disposal methodologies.** Wheeler, M.L.; Dragonette, K. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 13p. (CONF-810606—36). NTIS, PC A02/MF A01.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

This report covers the followng: (1) history of low level waste disposal; (2) current practice at the five major DOE burial sites and six commercial sites with dominant features of these sites and radionuclide content of major waste types summarized in tables; (3) site performance with performance record on burial sites tabulated; and (4) proposed solutions. Shallow burial of low level waste is a continuously evolving practice, and each site has developed its own solutions to the handling and disposal of unusual waste forms. There are no existing national standards for such disposal. However, improvements in the methodology for low level waste disposal are occurring on several fronts. Standardized criteria are being developed by both the Nuclear Regulatory Commission (NRC) and by DOE. Improved techniques for shallow burial are evolving at both commercial and DOE facilities, as well as through research sponsored by NRC, DOE, and the Environmental Protection Agency. Alternatives to shallow burial, such as deeper burial or the use of mined cavities is also being investigated by DOE.

21673 **(LBL—12478) Hydraulic fracturing and overcoring stress measurements in a deep borehole at the Stripa Test Mine, Sweden.** Doe, T.; Ingevald, K.; Strindell, L.; Haimson, B.; Carlsson, H. (Lawrence Berkeley Lab., CA (USA); Swedish State Power Board, Stockholm; Wisconsin Univ., Madison (USA); Swedish Nuclear Fuel Supply Co., Stockholm). Mar 1981. Contract W-7405-ENG-48. 9p. (CONF-810624—6). NTIS, PC A02/MF A01.

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

Recently, a workable method was developed for performing overcoring measurements in holes hundreds of meters in length. With the need to obtain in situ stress values for nuclear waste disposal simulation experiments at the Stripa Mine in central Sweden, the task of running both the Power Board's Leeman triaxial cell and hydraulic fracturing in the same hole was undertaken. This paper is a report of the results of the comparative measurements. 9 figures, 1 table.

21674 **(NVO—196-21) Nevada nuclear waste storage investigations. Quarterly report, October-December, 1980.** (Department of Energy, Las Vegas, NV (USA). Nevada Operations Office). Mar 1981. 91p. NTIS, PC A05/MF A01.

The investigations consist of a variety of studies and evaluations in support of the National Waste Terminal Storage program; objective is to determine whether rock media at or near Nevada Test Site are technically acceptable for a licensed, permanent, high-level nuclear waste repository. This document reports on: systems, waste package, site, repository, regulatory and institutional, test facilities, and program management. (DLC)

21675 **(ONWI—9(3)(1980)) Technical progress report for the quarter 1 April-30 June 1980.** (Battelle Columbus Labs., OH (USA)). 1980. Contract AC06-76RL01830. 449p. NTIS, PC A19/MF A01.

This report describes the technical accomplishments during the period from April through June 1980, on the commercial nuclear waste management programs under the direction of the Office of Nuclear Waste Isolation (ONWI). The National Waste Terminal Storage Program (NWTS) was established in 1976 and given the responsibility of developing a system for the permanent isolation of nuclear wastes. ONWI has lead responsibilities in the NWTS structure for oversight and coordination of all programs, for development of the general technology, and for geologic exploration on non-DOE land. A project management group, ONWI directs and evaluates studies, research, and development performed by subcontractors on repository sites and designs. The scope of ONWI activities includes providing the technology and facilities for the terminal isolation of these wastes by disposal in mined repositories deep underground in stable geologic formations. Steps leading to the accomplishment of that purpose include: (1) site exploration, characterization, and recommendation; (2) design, licensing, construction, and operation of a commercial geologic repository (or repositories); and (3) technology development to support these steps. Progress reports of the programs in the various waste management technologies are presented according to the following organization of the Work Breakdown Structure: science and technology; process/equipment development; systems analysis; site identification; facilities engineering; and site qualification and licensing.

**21676 (ONWI—75) Considerations for development of specifications for subsurface waste-handling equipment.** Arbital, J.; Bettis, E.; Myrick, T.; Watts, H.; Wilems, R.; Yook, H. (Science Applications, Inc., Oak Ridge, TN (USA)). Oct 1979. Contract AC06-76RL01830. 178p. NTIS, PC A09/MF A01.

Systems engineering techniques were used to develop a functional hierarchy and functional flow block diagrams for subsurface high-level radioactive waste handling. The block diagrams were then used as a basis for defining emplacement and retrieval system requirements from the repository level down to the subsurface waste handling equipment level, with resulting identification of design requisites necessary for equipment specification development. An emplacement system design envelope, consisting of design criteria and a specification outline, was developed from the requirements allocation. The key design analysis and decision areas are reviewed and various considerations and issues affecting these areas are identified. The factors influencing the decision process are also discussed. An example subsurface waste handling system concept was developed.

**21677 (ONWI—124) Logistics characterization for regional spent fuel repositories concept.** Joy, D.S.; Hudson, B.J.; Anthony, M.W. (Oak Ridge National Lab., TN (USA); Battelle Columbus Labs., OH (USA)). Aug 1980. Contract AC06-76RL01830. 147p. NTIS, PC A07/MF A01.

This report summarizes a study of logistics considerations for a four-region repository system for spent fuel disposal. The logistics considerations include: (1) yearly receipt and emplacement; (2) inventory; (3) away-from-reactor (AFR) storage; (4) nuclear capacity growth effects; (5) entire lifetime of reactors served by repository operations; (6) proportions of pressurized-water-reactor (PWR)/boiling-water-reactor (BWR) fuel; (7) proportions of rail and truck shipments; (8) shipping cask fleet requirements; (9) number of annual shipments; (10) mode (rail/truck) and cost of shipment; and (11) initial year for shipment to maintain full core reserve. The nation was divided into Northeast, North Central, Southern, and Western regions for evaluation purposes. Repository logistics were analyzed in each region based on three different capacity projections. For the Southern region, results for seven salt dome sites are presented. The Western region results cover four potential sites. The North Central and Northeastern regions results are not presented on a site specific basis. Conclusions are drawn based on the results. The methodology assumptions and references used in the logistics analysis are described for the convenience of the reader.

**21678 (ONWI—203) Retrievability: technical considerations.** Wilems, R.E.; Arbital, J.; Fowler, J.; Mosier, J.; Rickertsen, L.; Stevens, P. (Science Applications, Inc., Oak Ridge, TN (USA)). Sep 1980. Contract AC06-76RL01830. 150p. NTIS, PC A07/MF A01.

This study is intended to provide assistance to the Office of Nuclear Waste Isolation in formulating a position on nuclear waste retrievability from a geologic repository. A previous study was conducted by Science Applications, Inc., in which a methodology was developed to relate the length of a retrievability period to technical considerations, and a preliminary assessment was performed to establish the length of a retrievability period based on these technical considerations. In the present study, key technical considerations identified in the previous study as being related to the verification of confidence in site-specific repository performance are analyzed in more detail. The period required for verification was related to a retrievability period and the repository characteristics during such a retrievability period are identified and discussed.

**21679 (ONWI—234) Technical summary and index for national waste terminal storage repository No. 1 and No. 2 conceptual design reports, special study No. 6.** (Stearns-Roger Services, Inc., Denver, CO (USA)). Dec 1980. Contract AC06-76RL01830;AC06-77RL90283. 180p. NTIS, PC A09/MF A01.

This report is intended to facilitate the use of the Conceptual Design Reports prepared for NWTSR No. 1 and No. 2. The NWTSR No. 1 Conceptual Design Report prepared by Stearns-Roger consists of 21 volumes comprising 56 separately bound parts. The NWTSR No. 2 Conceptual Design Report prepared by Kaiser Engineers consists of 26 volumes comprising 44 separately bound parts. The Conceptual Design Criteria prepared by UCC-ND, X-OE-17 Y/OWI/TM-9 is also included. This report consists of three major sections: an overview discussion (Section II) a synopsis and summary of the volumes of the two CDR's (Section III) and a technical index (Section IV). In addition this report contains a brief glossary of terms used in discussing radioactive waste isolation in geologic formations (Section V).

**21680 (PNL—3702) Design and performance of atomizing nozzles for spray calcination of high-level wastes.** Miller, F.A.; Stout, L.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 52p. NTIS, PC A04/MF A01.

A key aspect of high-level liquid-waste spray calcination is waste-feed atomization by using air atomizing nozzles. Atomization substantially increases the heat transfer area of the waste solution, which enhances rapid drying. Experience from the spray-calciner operations has demonstrated that nozzle flow conditions that produce 70-$\mu$ median-volume-diameter or smaller spray droplets are required for small-scale spray calciners (drying capacity less than 80 L/h). For large-scale calciners (drying capacity greater than 300 L/h), nozzle flow conditions that produce 100-$\mu$ median-volume-diameter or smaller spray droplets are required. Mass flow ratios of 0.2 to 0.4, depending on nozzle size, are required for proper operation of internal-mix atomizing nozzles. Both internal-mix and external-mix nozzles have been tested at PNL. Due to the lower airflow requirements and fewer large droplets produced, the internal-mix nozzle has been chosen for primary development in the spray calciner program at PNL. Several nozzle air-cap materials for internal-mix nozzles have been tested for wear resistance. Results show that nozzle air caps of stainless steel and Cer-vit (a machineable glass ceramic) are suceptible to rapid wear by abrasive slurries, whereas air caps of alumina and reaction-bonded silicon nitride show only slow wear. Longer-term testing is necessary to determine more accurately the actual frequency of nozzle replacement. Atomizing nozzle air caps of alumina are subject to fracture from thermal shock, whereas air caps of silicon nitride and Cer-vit are not. Fractured nozzles are held in place by the air-cap retaining ring and continue to atomize satisfactorily. Therefore, fractures caused by thermal shocking do not necessarily result in nozzle failure.

**21681 (PNL-SA—9092) Effective summary evaluators for deep nuclear waste repositories: geohydrologic response function.** Nelson, R.W.; Dove, F.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Mar 1981. Contract AC06-76RL01830. 28p. (CONF-810372—1). NTIS, PC A03/MF A01.

From Symposium on uncertainties associated with the regulation of the geologic disposal of high-level radioactive waste; Gatlinburg, TN, USA (9 Mar 1981).

Useful insight has been gained over the past four years as hydrologic system modeling has been applied to evaluate hypothetical, waste-repository sites in various geologic media. The Geohydrologic Response Functions, described in this paper, are shown to: blend extensive results of technical analysis into simple summary relationships, and to potentially help the public and decision makers to evaluate the magnitude of any loss in repository integrity.

**21682 (PNL-SA—9231) Commercial US nuclear reactors and waste: the status, December 1980.** Platt, A.M.; Robinson, J.V. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1981. Contract AC06-76RL01830. 12p. (CONF-810217—16). NTIS, PC A02/MF A01.

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

Between March 1 and December 15, 1980, the declared size of the commercial light water reactor (LWR) nuclear power industry in the US decreased another 9 GW(e). For the presently declared size: the 165 declared reactors will peak at a capacity of 153 GWe in 2001 and will consume about 820,000 MTU as enrichment feed; the theoretical rate of enrichment requirements will peak at about 19,000,000 SWUs/y in the year 2014; as few as two repositories each with capacity equivalent to 77,000 MTHM would hold the waste; and predisposal storage reactor basins and AFRs (away-

from-reactor basins) would peak at < 65,000 MTU in the year 2016 if the two repositories were commissioned in the years 1997 and 2023.

21683 **(RHO-CD—972) Spent-fuel dry-storage-concept evaluation.** Singh, K.N.; LaRiviere, J.R. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 1981. Contract AC06-77RL01030. 184p. NTIS, PC A09/MF A01.

This report gives an assessment of several dry modes for interim storage of commercial light water reactor (LWR) spent fuel and recommends the dry well concept. The Dry Storage Facility (DSF) will receive, encapsulate, and store the canisterized spent fuel in vertical dry wells located near the ground surface. The canisters are designed to be retrievable. The study is based on locating the DSF at Hanford. However, only minor changes would be required if another site with similar climatic conditions were chosen.

21684 **(SAND—80-2016) Finite element model for heat conduction in jointed rock masses.** Gartling, D.K.; Thomas, R.K. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 12p. (CONF-810708—1). NTIS, PC A02/MF A01.

From 2. international conference on numerical methods in thermal problems; Venice, Italy (7 Jul 1981).

A computatonal procedure for simulating heat conduction in a fractured rock mass is proposed and illustrated in the present paper. The method makes use of a simple local model for conduction in the vicinity of a single open fracture. The distributions of fractures and fracture properties within the finite element model are based on a statistical representation of geologic field data. Fracture behavior is included in the finite element computation by locating local, discrete fractures at the element integration points.

21685 **(SAND—80-2096) Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program.** Gomez, L.S.; Marietta, M.G.; Hessler, R.R.; Smith, K.L. Jr.; Yayanos, A.A.; Jackson, D.W. (Sandia National Labs., Albuquerque, NM (USA); Scripps Institution of Oceanography, La Jolla, CA (USA); Concepts Development, Inc., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 16p. NTIS, PC A02/MF A01.

The US Subseabed Disposal Program is assessing the scientific feasibility of subseabed emplacement of high-level nuclear wastes. Studies of disposal methods and of the barriers to radionuclide migration (canister, waste form, and sediment) suggest that environmental information will be needed to address the impact of accidental release of radionuclides in the deep sea. Biological, physical, and geochemical data are being collected from field and laboratory studies as well as from literature searches. These data are being analyzed using a multicompartmental radionuclide transport model and appropriate physical oceanographic models. The data integrated into this framework will help answer two questions - what are the environmental effects of radionuclides that may be released in the deep sea, and what are the effects of such a release upon man.

21686 **(UCID—19034) Chemical, physical, and mineralogical characterization of fifteen sandstones for radionuclide sorption studies.** Shultz-McKinley, S.; Garrison, J.; MacLean, S.; Coles, D.G. (Lawrence Livermore National Lab., CA (USA)). 21 Apr 1981. Contract W-7405-ENG-48. 61p. NTIS, PC A04/MF A01.

Samples from fifteen different sandstone formations representing a wide variation in quartz content and secondary alteration products were studied to determine their mineralogical, physical and chemical characteristics. Techniques used included x-ray diffraction, optical petrography, surface area, particle size distribution, scanning electron microscopy, and cation exchange capacity. The data obtained in this study will be needed to determine radionuclide sorption coefficients as a function of varying mineral composition and other rock characteristics. This report documents the data so they will be conveniently available for use in subsequent sorption studies.

21687 (UCRL—15347, pp 46-57) **Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D.** Ringwood, A.E. (Australian National Univ., Canberra). 10 Feb 1981. NTIS, PC A08/MF A01.

In Mineral waste form development for US defense wastes. Progress report.

Experimental studies have shown that monazite is compatible with the SYNROC phase, hollandite, but not compatible with zirconolite or perovskite. However, monazite was found to be compatible with spinel ss and nepheline, two major phases in SYNROC-D (a titanate ceramic developed for defence waste immobilization). The suitability of monazite as an actinide host in a modified SYNROC-D formulation was likewise evaluated experimentally. Monazite did not accept U into its crystal lattice in any of our experiments. The ceramic products produced by the addition of monazite to model defence sludges showed substantial pitting, corrosion and partial loss of key elements such as uranium, during polished section preparation. This was especially evident with high-Na sludge calcines; the low-Na washed calcines yielded marginally better products. Materials with such obviously poor mechanical and leach-resistant characteristics would not prove acceptable as waste-forms. In view of the compatibility between monazite and hollandite a new two-phase waste-form might be considered, since hollandite has the capacity to accept Cs, Rb, Mo and Ba and monazite has the potential to accept REE, U, Th and possibly Sr into its crystal lattice, as evidenced by natural minerals and synthesis experiments. However, experiments suggest that in order for uranium (and hence tetravalent actinides) to be accommodated in the monazite lattice, extremely careful control and monitoring of waste-form processing conditions would be required. The resulting technical complexity in manufacturing a monazite-hollandite waste-form would seem to be rather unattractive.

21688 **The use of geostatistics in high level radioactive waste repository site characterization.** Doctor, P.G. (Battelle Pacific Northwest Labs, Wash). *Radioactive Waste Management (New York) ;* **1**: No. 2, 193-210(Sep 1980).

In evaluating and characterizing candidate sites for use as high level radioactive waste repositories, there is an increasing need to estimate the uncertainty in hydrogeologic data and in the quantities calculated from them. Geostatistical techniques to estimate hydrogeologic surfaces and to provide a measure of the uncertainty in that estimate are described. Maps of the uncertainty estimate can be used to determine where new data should be collected to effect the greatest reduction in uncertainty in the estimated surface. The methods are illustrated, using a set of site characterization data from the top-of-basalt elevations at the Hanford site near Richland, Wash.

21689 **Uranium and plutonium assay of created waste by gamma ray, singles neutron, and slow neutron coincidence counting.** Harlan, R.A. (Rockwell Int, Golden, Colo). *National Bureau of Standards (U.S.), Special Publication ;* 622-632(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Nuclear counting techniques were applied to plutonium contaminated waste in 4-ft by 4-ft by 7-ft wooden crates sealed with a fire retardant polyester plus fiberglass overcoat. The counting systems were proven to be useful for safeguards verification measurements and to some extent for accountability measurements. Neutron and gamma ray measurements both are recommended. 4 refs.

21690 **Monte Carlo calculational design of an NDA instrument for the assay of waste products from high enriched uranium spent fuels.** Eccleston, G.W.; Schrandt, R.G.; MacDonald, J.L.; Cverna, F.H. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 472-496(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The Monte Carlo design of the waste assay region of a dual assay system, to be istalled at the Fluorinel and Storage Facility, is described. The instrument will be used by the facility operator to assay high-enriched spent fuel packages and waste solids produced from dissolution of the fuels. The fissile content discharged in the waste is expected to vary between 0 and 400 g of U-235. 10 refs.

## 0530 Environmental Aspects

*REFER ALSO TO CITATION(S) 21681, 21685, 22608*

**21691 (LA—8811-PR) Environmental and radiological safety studies. Interaction of $^{238}PuO_2$ heat sources with terrestrial and aquatic environments. Progress report, October 1-December 31, 1980.** Waterbury, G.R. (comp.). (Los Alamos Scientific Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 45p. NTIS, PC A03/MF A01.

The containers for $^{238}PuO_2$ heat sources in radioisotope thermoelectric generators are designed with large safety factors to ensure that they will withstand reentry from orbit and impact with the earth and safely contain the nuclear fuel until it is recovered. Existing designs have proved more than adequately safe, but the Space and Terrestrial Division of the Department of Energy Office of Advanced Nuclear Systems and Projects continually seeks more information about the heat sources to improve their safety. The work discussed here includes studies of the effects on the heat source of terrestrial and aquatic environments to obtain data for design of even safer systems. The data obtained in several ongoing experiments are presented; these data tables will be updated quarterly. Discussions of experimental details are minimized and largely repetitive in succeeding reports. Compilations of usable data generated in each experiment are emphasized. These compilations include data from environmental chamber experiments that simulate terrestrial conditions, experiments to measure $PuO_2$ dissolution rates, soil column experiments to measure sorption of plutonium by soils, and several aquatic experiments.

**21692 (PNL—3817) Use of Geohydrologic Response Functions in the assessment of deep nuclear waste repositories: assessment of effectiveness of geologic isolation systems.** Nelson, R.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 53p. NTIS, PC A04/MF A01.

Geohydrologic Response Functions (GRFs) interrelate the three vital factors needed in the repository decision-making process: the quantity, arrival time, and location of contamination reaching the biosphere. GRFs further focus attention upon two related and additive parameters: the initial delay time and delay spread time. After the principal site selection, the GRFs may be applied to obtain more detailed performance evaluations concerning specific nuclides or waste components, specific results for various types of accidental release, and effects of a variety of contaminant source terms or leach models. The response functions may be applied to consider contaminant reductions and delays through material sorption as well as through a variety of other interactions and effects.

## 0540 Health And Safety

*REFER ALSO TO CITATION(S) 21619, 22695*

## 0550 Regulations

*REFER ALSO TO CITATION(S) 21646, 21647, 21650, 21665, 21689, 21690, 22026, 22064, 22330, 22350, 22351, 22352, 22353, 22354, 22355, 22357, 22358, 22359, 22517*

**21693 (CONF-810548—3) Quadrupole mass spectrometer for a mobile laboratory to measure isotope ratios.** Walton, J.R.; Smith, D.H.; McKown, H.S.; Carter, J.A. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 2p. NTIS, PC A02/MF A01.

From 29. annual conference on mass spectrometery; Minneapolis, MN, USA (24 May 1981).

A mobile laboratory has been assembled for on-site inspection of plant operations handlng special nuclear materials. The isotopic composition of U, Pu, and other elements can be analyzed using a quadrupole mass spectrometer. Some results of analysis of uranium and boron standards are given. (DLC)

**21694 (LA—8809-MS) Materials measurement and accounting in an operating plutonium conversion and purification process. Phase I. Process modeling and simulation.** Thomas, C.C. Jr.; Ostenak, C.A.; Gutmacher, R.G.; Dayem, H.A.; Kern, E.A. (Los Alamos Scientific Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 32p. NTIS, PC A03/MF A01.

A model of an operating conversion and purification process for the production of reactor-grade plutonium dioxide was developed as the first component in the design and evaluation of a nuclear materials measurement and accountability system. The model accurately simulates process operation and can be used to identify process problems and to predict the effect of process modifications.

**21695 (LA-UR—81-1402) Inspector-instrument interface in portable NDA instrumentation.** Halbig, J.K.; Klosterbuer, S.F. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 7p. (CONF-810502—9). NTIS, PC A02/MF A01.

From 3. symposium on safeguards and nuclear material management; Karlsruhe, F.R. Germany (6 May 1981).

Recent electronics technology advances make it possible to design sophisticated instruments in small packages for convenient field implementation. This report describes an inspector-instrument interface design which allows communication of procedures, responses, and results between the instrument and user. The interface has been incorporated into new spent-fuel instrumentation and a battery-powered multichannel analyzer.

**21696 (LA-UR—81-1510) 870.8-keV gamma ray from $PuO_2$.** Hsu, H.H. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 12p. (CONF-810647—5). NTIS, PC A02/MF A01.

From Conference on X-and gamma-ray sources and applications; Ann Arbor, MI, USA (10 Jun 1981).

A $^{252}Cf$ neutron source and an $^{241}Am$ alpha source were used with isotopically enriched water containing 43.9% $^{17}O$ and 43.1% $^{18}O$, to study the (n,n'Y) and ($\alpha$,$\alpha$'Y) reactions in $^{17}O$ and $^{18}O$. The production yields for the 870.8-keV gamma ray from $^{17}O$ and the 1982.2-keV gamma ray from $^{18}O$ were measured. In addition, the average cross sections over the $^{252}Cf$ fission neutron spectrum for $^{17}O(n,n'Y)^{17}O$ and $^{18}O(n,n'Y)^{18}O$ were determined.

**21697 (LA-UR—81-1512) CAMAC gamma ray scanning system.** Moss, C.E.; Pratt, J.C.; Shunk, E.R. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 30p. NTIS, PC A03/MF A01.

A flexible gamma-ray scanning system, based on a LeCroy 3500 multichannel analyzer and CAMAC modules, is described. The system is designed for making simultaneous passive and active scans of objects of interest to nuclear safeguards. The scanner is a stepping-motor-driven carriage; the detectors, a bismuth-germanate scintillator and a high-purity germanium detector. A total of sixteen peaks in the two detector-produced spectra can be integrated simultaneously, and any scan can be viewed during data acquisition. For active scanning, the 2615-keV gamma-ray line from a $^{232}U$ source and the 4439-keV gamma-ray line from $^{9}Be(\alpha,n)^{12}C$ were selected. The system can be easily reconfigured to accommodate up to seven detectors because it is based on CAMAC modules and FORTRAN. The system is designed for field use and is easily transported. Examples of passive and active scans are presented.

**21698 (SAND—81-0495C) Concepts on integration of physical protection and material accounting functions in a safeguards system.** Reynolds, D.A. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 3p. (CONF-810706—1). NTIS, PC A02/MF A01.

From Institute of Nuclear Materials Management conference; San Francisco, CA, USA (13 Jul 1981).

Concepts on integration of physical protection and material accounting systems to enhance overall safeguards capability are developed and presented. These concepts identify ways in which material accounting systems can be used to enable effective monitoring of authorized movement of nuclear material through physical protection boundaries. Concepts are also discussed for monitoring user

access to nuclear material and for tagging user identification to material accounting transactions through physical protection functions. These result in benefits in detecting diversion and in positively tracing material movement. Finally, coordination of safeguards information from both subsystems in such an integrated system through a safeguards coordination center is addressed with emphasis on appropriate response in case of discrepancies.

**21699 International safeguards at the feed and withdrawal area of a gas centrifuge uranium enrichment plant.** Gordon, D.M.; Sanborn, J.B. (Brookhaven Natl Lab, Upton, NY). *National Bureau of Standards (U.S.), Special Publication ;* 261-275(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

This paper discusses the application of International Atomic Energy Agency (IAEA) safeguards at a model gas centrifuge uranium enrichment plant designed for the production of low-enriched uranium; particular emphasis is placed upon the verification by the IAEA of the facility material balance accounting. 13 refs.

**21700 Measurement technology for safeguards and materials control, proceedings from American Nuclear Society Topical Meeting, 1979.** Canada, T.R. (Ed.); Carpenter, B.S. (Ed.). (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* vp(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

This conference proceedings contains 61 papers, 60 of which are indexed separately. The subject matter included applications which offered a good balance between chemical analysis, nondestructive assay techniques, bulk measurement techniques, inspection techniques, and integrated systems for material measurements and control. Reports discussing preparation and use of reference materials and measurement traceability were included. Examples of measurement requirements and techniques used for both national and international safeguards are given. Approaches to various analysis of materials throughout the fuel cycle from enrichment and fuel fabrication to spent fuel and reprocessing are considered.

**21701 Reference materials and measurement traceability.** Bingham, C.D. (US DOE, Argonne, Ill). *National Bureau of Standards (U.S.), Special Publication ;* 1-14(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Nuclear materials safeguards within the U.S.A. are accomplished by the integration of activities involving physical protection, material control and material accountability. Material accountability requires both sound measurement technology and well-defined accounting procedures to provide final evidence that physical protection and materials control have achieved their purpose. 5 refs.

**21702 Preparation of prototype NDA reference materials: a progress report.** Voeks, A.M.; Trahey, N.M. (US DOE, Argonne, Ill). *National Bureau of Standards (U.S.), Special Publication ;* 25-33(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Three prototype NDA reference materials for scrap and waste have been developed at the New Brunswick Laboratory for use in an interlaboratory evaluation program. They are ion exchange resin, cellulose fiber and synthetic calcined ash. A total of 19 reference materials containing varying amounts of enriched uranium were prepared. Details of the preparation, packaging and characterization are described. 4 refs.

**21703 Nuclear materials analysis using plasma desorption mass spectometry.** Ulbricht, W.H. Jr. (US DOE, Argonne, Ill). *National Bureau of Standards (U.S.), Special Publication ;* 66-78(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

A unique time-of-flight mass spectrometer has been built to make use of a process referred to as plasma desorption to measure isotope ratios of materials which contain fissionable material. Plasma desorption is the very rapid and energetic process by which a fission fragment may desorb and ionize minute portions of the sample. 4 refs.

**21704 Inventory verification methods in DOE safeguards inspections.** Smith, G.S.; Inlow, R.O. (US DOE, Albuquerque, NM). *National Bureau of Standards (U.S.), Special Publication ;* 178-188(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The most difficult and complex activities of a nuclear materials safeguards survey are inventory testing and appraising the measurement systems. The Albuquerque Operations Office considers remeasurement as the key to assuring both the quality of the inventory and the reliability of the measurements. Remeasurement efforts include the use of contractor instruments, our own portable and transportable equipment, and reference laboratories. The topics covered in this paper are conveniently divided into Onsite Verification, Offsite Verification, and some examples.

**21705 Tamper recorder for unattended safeguards instruments.** Smathers, D.C. (Sandia Lab, Albuquerque, NM). *National Bureau of Standards (U.S.), Special Publication ;* 257-260(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The Secure Counter Panel is an electro-mechanical module which records attempts to tamper with instruments of an unattended safeguards system in a way which cannot be sabotaged or bypassed without leaving obvious evidence of tampering. A number of novel tamper-safing techniques are included in the design some of which are widely applicable to other safeguards instruments.

**21706 NDA for the SRP fuel fabrication process.** Studley, R.V. (DuPont, Aiken, SC). *National Bureau of Standards (U.S.), Special Publication ;* 276-307(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The Savannah River Plant fuel fabrication process is described to illustrate requirements for a variety of assay techniques. Criteria and design of some NDA systems for this process are discussed. Initial performance of a neutron activation analysis system (californium shuffler) as an assay method for several varieties of material is reported.

**21707 In-line monitor of plutonium holdup in glovebox filters.** Li, T.K.; Marshall, R.S. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 308-312(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

An in-line filter holdup monitoring system has been designed and installed in the Los Alamos Scientific Laboratory (LASL) Plutonium Processing Facility to detect plutonium buildup in a glovebox exhaust filter. The filter is located on top of a glovebox in which plutonium and uranium oxide and carbon are blended, milled, and prepared for making advanced fast breeder reactor (FBR) fuel.

**21708 Automated in-line measurement of nuclear fuel pellets.** McLemore, D.R.; Nyman, D.H. (Hanford Eng Dev Lab, Richland, Wash). *National Bureau of Standards (U.S.), Special Publication ;* 342-364(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The Hanford Engineering Development Laboratory (HEDL) operated by the Westinghouse Hanford Company for the United States Department of Energy is currently developing, fabricating, and evaluating automated fuel farication equipment. This program has as its major goals: reduced personnel exposure, improved safeguards/accountability and improved fuel performance. 4 refs.

**21709 Passive nuclear material detection in a personnel portal.** Fehlau, P.E.; Eaton, M.J. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 365-371(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The concepts employed in the development of gamma-ray and neutron detection systems for a special nuclear materials booth portal monitor are described. The portal is designed for unattended use in detecting diversion by a technically sophisticated adversary and has possible application to International Atomic Energy Agency safeguards of a fast critical assembly facility. Preliminary evaluation results are given and plans for further parameter studies are noted. 18 refs.

**21710 Active neutron technique for detecting attempted special nuclear materials diversion.** Smith, G.W.; Rice, L.G. III. (Sandia Lab, Albuquerque, NM). *National Bureau of Standards (U.S.), Special Publication ;* 372-390(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Control of a special nuclear material (SNM) inventory implies the capability to identify attempted SNM diversion. (SNM is defined for this purpose as U-235 and Pu-239, fissile isotopes of Uranium and Plutonium.) This control is presently based on the detection of radiation from either natural radioactive decay or fission. The threat of SNM concealment by radiation shielding materials seriously limits all methods currently used for this purpose. For this reason, efforts, under the auspices of DOE, are underway to develop a method to detect sophisticated attempts to conceal and divert SNM. 5 refs.

**21711 Study of a two-detector method for measuring plutonium isotopics.** Fleissner, J.G.; Lemming, J.F.; Jarvis, J.Y. (Monsanto Res Corp, Miamisburg, Ohio). *National Bureau of Standards (U.S.), Special Publication ;* 555-567(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

A technique to improve the timeliness and accuracy of Pu isotopic measurements for bulk samples has been studied. The technique utilizes two Ge detectors to simultaneously assay different energy regions of the Pu gamma-ray spectrum, Isotopic ratios are determined from the areas of close lying peak pairs. Factors determining the choice of these peak pairs for the total isotopic measurement are discussed. 9 refs.

**21712 Gamma ray NDA assay system for total plutonium and isotopics in plutonium product solutions.** Cowder, L.R.; Hsue, S.T.; Johnson, S.S.; Parker, J.L.; Russo, P.; Sprinkle, J.K.; Asakura, Y.; Fukuda, T.; Kondo, I. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 568-583(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

A LASL-designed gamma-ray NDA instrument for assay of total plutonium and isotopics of product solutions at Tokai-Mura is currently installed and operating. The instrument is, optimally, a densitometer that uses radioisotopic sources for total plutionium measurements at the K absorption edge. The densitometer is discussed in sections describing II) measurement principles and experimental design, III) hardware design, IV) software design, V) concepts of analysis, and VI) preliminary results. 5 refs.

**21713 Goals of measurement systems for international safeguards.** de Montmollin, J.M.; Weinstock, E.V. (Sandia Lab, Albuquerque, NM). *National Bureau of Standards (U.S.), Special Publication ;* 651-669(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The safeguards applied by the International Atomic Energy Agency are based on technical performance goals and criteria that have been developed by the Agency. In this paper safeguards goals and criteria and their underlying rationales are critically examined. Suggestions for a more rational and workable structure of performance goals are offered. 22 refs.

**21714 Evolution of safeguards systems design.** Shipley, J.P.; Christensen, E.L.; Dietz, R.J. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 670-676(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Safeguards systems play a vital detection and deterrence role in current nonproliferation policy. These safeguards systems have developed through the evolution of three essential components: the safeguards/process interface, safeguards performance criteria, and the technology necessary to support effective safeguards. This paper discusses the background and history of this evolutionary process, its major developments and status, and the future direction of safeguards system design. 25 refs.

**21715 Materials accounting considerations for international safeguards in a light-water reactor fuels reprocessing plant.** Hakkila, E.A.; Cobb, D.D.; Dayem, H.A.; Dietz, R.J.; Kern, E.A.; Shipley, J.P. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 718-729(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

This paper summarizes the requirements and functions of materials measurement and accounting systems applicable to large (1500 metric tonnes heavy metal per year--MTHM/yr) future reprocessing facilities as well as small (210 MTHM/yr) plants that are presently under IAEA safeguards. The effectiveness of conventional and proposed improved measurement and accounting systems were compared. 13 refs.

**21716 New developments in nondestructive measurement and verification of irradiated lwr fuels.** Lee, D.M.; Phillips, J.R.; Halbig, J.K.; Hsue, S.T.; Kaieda, K.; Dermendjiev, E.; Lindquist, L.O.; Ortega, E.M.; Caine, J.C.; Swansen, J. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 426-446(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Nondestructive techniques for characterizing irradiated LWR fuel assemblies are discussed. This includes detection systems that measure axial activity profile, neutron yield and gamma yield. A multi-element profile monitor has been developed that offers a significant improvement in speed and comlexity over existing mechanical scanning systems. New portable detectors and electronics, applicable to safeguard inspection, are presented and results of gamma-ray and neutron measurments at commercial reactor facilities are given. 11 refs.

**21717 In-situ verification techniques for fast critical assembly cores.** Brumbach, S.B.; Amundson, P.I.; Roche, C.T. (Argonne Natl Lab, Idaho Falls, Idaho). *National Bureau of Standards (U.S.), Special Publication ;* 391-425(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Active and passive autoradiographic techniques were used to obtain piece counts of fuel plates in fast critical assembly drawers and to verify the assembly loading pattern. Active autoradiography using prompt-fission and fission-product radiation was more successful with uranium fuel while passive autoradiography was more successful with plutonium fuel. A source multiplication technique was used to measure changes in reactivity when small quantities (2-2.5 kg) of fissile material were removed from a subcritical reference core of the Zero Power Plutonium Reactor. 13 refs.

**21718 LASL analytical chemistry program for fissionable materials safeguards.** Jackson, D.D.; Marsh, S.F. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 129-139(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Major tasks in this program are (1) development of dissolution techniques for refractory nuclear materials, (2) development of

methods and automated analyzers for determining plutonium, uranium, and thorium, (3) preparation of plutonium reference materials distributed as certified reference materials by the National Bureau of Standards, and (4) preparation and characterization of plutonium isotope materials. 6 refs.

# 06 FUSION FUELS

## 0602 Processing

*REFER ALSO TO CITATION(S) 22374, 22375*

21719 **(UCRL—84475(Rev.1)) Ultrasmooth plasma polymerized coatings for laser-fusion targets.** Letts, S.A.; Myers, D.W.; Witt, L.A. (Lawrence Livermore National Lab., CA (USA)). 26 Aug 1980. Contract W-7405-ENG-48. 23p. (CONF-801037—12(Rev.1)). NTIS, PC A02/MF A01.

From American Vacuum Society conference; Detroit, MI, USA (13 Oct 1980).

Coatings for laser fusion targets were deposited up to 135 μm thick by plasma polymerization onto 140 μm diameter DT filled glass microspheres. Ultrasmooth surfaces (no defect higher than 0.1 μm) were achieved by eliminating particulate contamination. Process generated particles were eliminated by determining the optimum operating conditions of power, gas flow, and pressure, and maintaining these conditions through feedback control. From a study of coating defects grown over known surface irregularities, a quantitative relationship between irregularity size, film thickness, and defect size was determined. This relationship was used to set standards for the maximum microshell surface irregularity tolerable in the production of hydrocarbon or fluorocarbon coated laser fusion targets.

21720 **(UCRL—85140) Metallic and nonmetallic coatings for ICF targets.** Hendricks, C.D.; Crane, J.K.; Hsieh, E.J.; Meyer, S.F. (Lawrence Livermore National Lab., CA (USA)). 17 Apr 1981. Contract W-7405-ENG-48. 25p. (CONF-810425—6). NTIS, PC A02/MF A01.

From International conference on metallurgical coatings; San Francisco, CA, USA (6 Apr 1981).

Some fusion targets designed to be driven by 0.35 to 1 μm laser light are glass spheres coated with layers of various materials such as hydrocarbons, fluorocarbons, beryllium, copper, gold, platinum, etc. The glass shell, which is filled with gas, liquid or solid deuterium-tritium fuel, must have remarkably good surface and wall thickness uniformity. Methods for depositing the various materials will be discussed. They include plasma polymerization, electrodeposition, sputtering and evaporation. Many of the difficulties encountered in the coating processes are the result of coating on free spheres with very small radii - 35 to 500 micrometers. Several means of overcoming the problems will be described and experimental results presented.

## 0603 By-products

*REFER ALSO TO CITATION(S) 21723*

# 07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

## 0701 Physical Isotope Separation

*REFER ALSO TO CITATION(S) 22394*

## 0702 Radiation Sources

21721 **$10^{13}$/s 14 MeV neutron generator for cancer therapy.** Walko, R.J.; Bacon, F.M.; Bickes, R.W. Jr.; Cowgill, D.F.; Boers, J.E.; Riedel, A.A.; O'Hagan, J.B. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 975-982(Apr 1981).

A high output D-T neutron generator is being developed at Sandia National Laboratories as a cancer therapy tool. Preliminary results have been obtained with a high vacuum deuterium accelerator consisting of a duopigatron ion source, single stage accelerator, and a scandium occluder target. The ion source and accelerating system have been optimized to reliably focus a 200 mA, 200 kV deuterium ion beam onto the scandium target 1.5 m away with a beam spot size of $10^{-3}m^2$. The scandium target degrades due to implantation of impurities from the unbaked vacuum system. A UHV accelerator is being fabricated which will permit a 450 °C bakeout to alleviate the impurity problem. This system will also be compatible with the use of tritium, a necessary component of the therapy machine.

## 0703 Isotopic Power Supplies

*REFER ALSO TO CITATION(S) 22153*

# 08 HYDROGEN

## 0801 Production

*REFER ALSO TO CITATION(S) 22160, 22161*

21722 **(UCRL—85743) Proposed solar-furnace study of zinc sulfate decomposition.** Krikorian, O.H.; Shell, P.K. (Lawrence Livermore National Lab., CA (USA)). 16 Apr 1981. Contract W-7405-ENG-48. 7p. (CONF-810469—1). NTIS, PC A02/MF A01.

From Solar Thermal Test Facilities Users Association annual business and technical meeting; Pasadena, CA, USA (20 Apr 1981).

A solar furnace study of zinc sulfate is proposed. In this study the advantages of the high temperatures and rapid heating rates provided by solar collectors for the decomposition of zinc sulfate will be investigated. The use of a rotary kiln designed to improve the efficiency in working with solids that have low absorbtivities, such as solid sulfates, is planned. The overall goal in this experiment is to establish the applicability of solar central receivers to thermochemical cycles that can use solid state sulfate decomposition as the high temperature step. The $ZnSO_4$ subcycle presents a number of operational advantages over the direct decomposition of $H_2SO_4$ in the thermochemical process of hydrogen production from water. For instance, the cycle efficiency should increase due to reducing the heat requirements for evaporating water in the sulfuric acid concentration step. Also, a number of severe materials problems will be avoided for heat exchangers required to concentrate, boil, and decompose sulfuric acid. Furthermore, zinc sulfate lends itself well to coupling with solar central receivers, an alternative energy source which may introduce several additional advantages to sulfate-based thermochemical cycles.

21723 **Fusion-synfuel tie producing hydrogen with the tandem mirror.** Werner, R.W. (Lawrence Livermore National Lab., CA). Contract W-7405-ENG-48. pp 1662-1667 of Bound collection of technical papers of 15th intersociety energy conversion engineering conference. New York, NY; American Institute of Aeronautics and Astronautics (1980).

From 15. intersociety energy conversion engineering conference; Seattle, WA, USA (18 Aug 1980).

We report on the beginning of a study to determine how the fusion program, and particularly the future Tandem Mirror Reactor, can benefit and support the production of synthetic, portable fuels that are vital to the economy of the US. In the case under study the reactor is used as a 1200 K heat source driving a thermochemical cycle whose output product is hydrogen. Principal focus is placed on the conceptual design of the reactors main energy source, the blanket module. The module under study is a LiNa Cauldron design which is a binary, liquid metal pool boiler using lithium as the neutron moderator and sodium as the heat transfer fluid with latent heat as the main energy transport mechanism.

### 0802 Storage

*REFER ALSO TO CITATION(S) 22368*

**21724 Investigation of liquid hydrogen as a vehicular fuel.** Steward, W.F.; Edeskuty, F.J. pp 19-23 of Cryogenic processes and equipment in energy systems conference, 1980. Toscano, W.M.; Longsworth, R.C.; Zimmermann, F.J.; Gottzmann, C.F. (eds.). New York, NY; American Society of Mechanical Engineers (1980).

From Cryogenic processes and equipment conference; San Francisco, CA, USA (19 Aug 1980).

This paper describes a cooperative evaluation and state-of-the-art demonstration project for a hydrogen-fueled vehicle with liquid hydrogen on-board storage and refueling capabilities. The evaluation will include safety, economic, and energy assessments for this use of liquid hydrogen as a fuel. The project provides a baseline system representing present capabilities in engine conversion, liquid hydrogen storage, and liquid hydrogen refueling. 8 refs.

### 0803 Transport

*REFER ALSO TO CITATION(S) 22269*

### 0804 Marketing And Economics

*REFER ALSO TO CITATION(S) 21724*

### 0806 Industrial And Commercial Use

**21725 (DOE/CE—0005) Hydrogen-via-Electricity concept. Critique report.** Escher, W.J.D.; Ecklund, E.E. (Foster Technology Associates, Inc., St. Johns, MI (USA); Department of Energy, Washington, DC (USA). Office of Transportation Programs). Jan 1981. 78p. NTIS, PC A05/MF A01.

The Hydrogen-via-Electricity (HvE) concept is the prospective use of hydrogen fuel, produced electrolytically from the electric utility grid, as a means of responding to conventional fuels shortages. This report makes available the two sets of comments and critiques of this concept solicited from the Government/Government contractor group and from the electric utility companies.

### 0808 Properties

*REFER ALSO TO CITATION(S) 22269*

## 09 OTHER SYNTHETIC AND NATURAL FUELS

### 0901 Hydrocarbon Fuels

*REFER ALSO TO CITATION(S) 21520*

**21726 (DOE/CS/24310—3) Full scale field demonstration of unheated anaerobic contact stabilization. Project status report, October 1980-February 1981.** Sykes, R.M. (Ohio State Univ., Columbus (USA). Dept. of Civil Engineering). Apr 1981. Contract AC02-80CS24310. 8p. NTIS, PC A02/MF A01.

The objective of the study reported here is to demonstrate that municipal sewage sludges can be anaerobically digested with little or no heating. To this end, two digesters at the Jackson Pike Wastewater Treatment Plant in Columbus, Ohio, have been converted to the anaerobic contact stabilization process. This, it is hoped, will permit positive and independent control of the solids retention time (SRT) in the system, so that solids may be retained long enough to ensure substantially complete digestion even at reduced temperatures. Digestion at a temperature of 71°F and an SRT of 33 days produces results similar to digestion at a temperature of 91°F and an SRT of 11 days. There is no evidence of impaired or unstable digestion at the lower temperature. (DMC)

**21727 (LBL—12146) Strong ignition limits for methane-hydrogen mixtures.** Cheng, R.K.; Oppenheim, A.K. (Lawrence Berkeley Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 11p. (CONF-810704—5). NTIS, PC A02/MF A01.

From 1. international specialists meeting of the Combustion Institute; Bordequx, France (20 Jul 1981).

A study of the auto-ignition behind relected shock in eleven mixtures of $CH_4$-$O_2$, $H_2$-$O_2$, and $CH_4$-$H_2$-$O_2$ covering a temperature range of 900 to 2400°K and pressure range of 1 to 3 atm was carried out. The induction times were correlated with an equation of the Arrhenius form that was found to be quite satisfactory. All the strong ignition limits determined could be expressed in terms of a constant value expressed in terms of the partial derivative of induction time with respect to temperature at constant pressure, deduced for each mixture from the correlation equation being quite insensitive to variations in initial mixture compositions for the induction time. The values for the strong ignition limits for all test mixtures used were grouped around -0.5 μsec/K and thermodynamic conditions. This leads to the conclusion that the dominating factor in establishing the actual level of the strong ignition limit is the sensitivity of the induction time to temperature. Comparison of the strong ignition limit of the present $H_2$-$O_2$ mixture with 90% A dilution to that of the undiluted mixture measured in an earlier study of Meyer and Oppenheim showed that the addition of diluent caused the strong ignition value to decrease from -1.5 μsec/K to -0.5 μsec/K.

**21728 (NYSERDA—80-21) Methane-production-rate studies and gas-flow modeling for the Fresh Kills landfill.** Kunz, C.O.; Lu, A.H. (New York State Dept. of Health, Albany (USA). Div. of Labs. and Research (USA)). Nov 1980. 82p. New York State Energy Research and Development Authority, Albany, NY.

Methane is produced in landfills by anaerobic bacteria in the digestion of various organic materials found in the wastes. With the increasing cost of fuels the recovery of methane can be economic for some landfills. The rate of methane production can vary widely depending on factors such as the moisture content of the wastes, the pH, toxicity, temperature and the amount of organic material available. Information regarding the rate of gas production and gas flow during pumping is needed to determine the potential of a site for methane recovery and in the design of a recovery system. The primary objective of this study was to develop gas flow models based on measurements of the pressure differential between landfill gas and atmospheric pressure that would enable the rate of gas production to be estimated. In the course of this investigation two landfill gas flow models were developed; a static model and a dynamic model.

**21729 (SERI/TR—98174-1) Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980.** Colberg, P.J.; Baugh, K.; Everhart, T.; Bachmann, A.; Harrison, D.; Young, L.Y.; McCarty, P.L. (Stanford Univ., CA (USA). Dept. of Civil Engineering). Mar 1981. Contract AC02-77CH00178. 101p. NTIS, PC A06/MF A01.

The objective of this study is to develop an understanding of pretreatment methods which are applicable to many potential organic materials of interest. The aim of pretreatment is to convert natural organic materials into less complex substrates which are more readily biodegradable by methane-producing organisms. The results will be an increase in the yield of methane from a given quantity of material and at the same time a reduction in the quantity of residual organics requiring further costly processing and final disposal. This report describes the results of the final year's effort of this 3 year program. The autohydrolysis process has been selected as the most promising option from among several potential processes, and much of the work has focused on improving understanding of this process.

**21730 (SERI/TR—98175-1) Feasibility study for anaerobic digestion of agricultural crop residues. 1980 update. Final report.** West, C.E.; Ashare, E. (Dynatech R/D Co., Cambridge, MA (USA)). Mar 1981. Contract AC02-77CH00178. 170p. NTIS, PC A08/MF A01.

The objective of this study was to provide cost estimates for the digestion of corn stover to fuel gas. Engineering economic anal-

yses were performed for digestion of corn stover for small farm cooperative and industrial scales. The small farm scale processed the residue from an average size U.S. farm (400 acres), and the other sizes were two and three orders of magnitude greater. Recent experimental results obtained by Gaddy and by McCarty for yield and kinetics of corn stover digestion were used in the analysis. The results of the analyses indicate that production of fuel gas from corn stover is, at least, marginally economically feasible for both continuous and batch digestion processes. A sensitivity analysis was performed to assess which parameters significantly affect system economics. It was found that a credit for digester effluent would yield economically feasible process. Recommendations arising from this study include continued development of a batch hole-in-the-ground controlled landfill digestion of corn stover and investigations into the effect of shorter retention time continuous digestion. The digester effluent should also be evaluated to determine its use as an animal feed or fertilizer.

21731 **(UCRL—85409) Experimental and theoretical study of flame inhibition by bromine-containing compounds.** Westbrook, C.K.; Beason, D.G.; Alvares, N.J. (Lawrence Livermore National Lab., CA (USA)). 20 Jan 1981. Contract W-7405-ENG-48. 6p. (CONF-810704—1). NTIS, PC A02/MF A01.

From 1. international specialists meeting of the Combustion Institute; Bordequx, France (20 Jul 1981).

The present paper represents the first effort to date in which a combined experimental and theoretical approach has been used to study the effects of several inhibitors on hydrocarbon-air flames. This work is part of an attempt to build a consistent picture of chemical kinetic flame inhibition, beginning with a simple halogen molecule such as HBr and progressing sequentially towards more complex and more practical inhibitors such as $CF_3Br$. Inhibition efficiency can be defined as the rate of flame speed reduction, the amount of flame speed change per unit inhibitor added. Both the numerical model and the flame tube measurements found that the inhibition efficiency gradually decreases as the amount of inhibitor is increased. The present experimental and modeling results are shown, together with earlier data for $CF_3Br$-$CH_4$-air and $CF_3Br$-$C_3H_8$-air as well as HBr-$CH_4$-air, $CH_3Br$-$CH_4$-air and $CF_3Br$-$CH_4$-air. In the numerical study it was found that a stoichiometric methane-air mixture with up to 8% methyl bromide could support a flame, propagating at a speed of about 5 cm/sec, even though the addition of the first 1% of $CH_3Br$ had reduced the flame speed from 38 cm/sec to about 26 cm/sec. Extensions of the model to include $CF_3Br$ are currently under development. The available experimental data suggest that $CF_3Br$ is somewhat more efficient as an inhibitor than HBr or $CH_3Br$.

### 0902 Alcohol Fuels

*REFER ALSO TO CITATION(S) 21618, 22140*

21732 **(DOE/CS/40352—T2) Energy conservation in ethanol production from renewable resources and non-petroleum energy sources.** (Centec Corp., Reston, VA (USA)). Mar 1981. Contract AC01-80CS40352. 63p. NTIS, PC A04/MF A01.

The dry milling process for the conversion of grain to fuel ethanol is reviewed for the application of energy conservation technology, which will reduce the energy consumption to 70,000 Btu per gallon, a reduction of 42% from a distilled spirits process. Specific energy conservation technology applications are outlined and guidelines for the owner/engineer for fuel ethanol plants to consider in the selection on the basis of energy conservation economics of processing steps and equipment are provided. The process was divided into 5 sections and the energy consumed in each step was determined based on 3 sets of conditions; a conventional distilled spirits process; a modern process incorporating commercially proven energy conservation; and a second generation process incorporating advanced conservation technologies which have not yet been proven. Steps discussed are mash preparation and cooking, fermentation, distillation, and distillers dried grains processing. The economics of cogeneration of electricity on fuel ethanol plants is also studied. (MCW)

21733 **Synopsis of interim final report, conceptual design of a coal-to-methanol commercial plant.** Changelian, G.P. (Badger Energy, Inc., Cambridge, Mass). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

This paper presents a synopsis of the conceptual design of a commercial facility to produce methanol from coal. The categories addressed are support facilities, financial summary and plant capacity and market aspects. 3 refs.

### 0904 Solid Waste And Wood Fuels

*REFER ALSO TO CITATION(S) 22238*

21734 **Energy generation & cogeneration from wood.** Madison, WI; Forest Products Research Society (1980). 186p. (CONF-800246—).

From Forest Products Research Society: Energy from forest products; Atlanta, GA, USA (Feb 1980).

The papers presented at the conference are included in this volume. Discussions from the four workshops are also provided. The subjects covered in the workshops are: materials handling; combustion technologies - pile, grate, and suspension systems; gasification and pyrolysis systems; and cogeneration. Separate abstracts for each paper have been prepared for inclusion in the Energy Data Base. (DMC)

## 13 HYDRO ENERGY

### 1305 Economics And Management

21735 **Computer model for small-scale hydropower policy analysis.** Kirshen, P.H. (Virginia Polytechnic Inst. and State Univ., Blacksburg); Amlin, J.S. Contract EY-78-5-02-4943. *Journal of the Water Resources and Planning and Management Division, Proceedings of the American Society of Civil Engineers ;* **107**: No. WR1, 61-76(Mar 1981).

A computer simulation model of the obstacles and incentives to the development of small-scale hydropower in New England is presented. It serves as an effective communication tool between analysts and policymakers, helping them understand the implication of policy recommendations to increase small-hydropower development. Only four of the factors affecting development are included in the model: economics, licensing, construction, and retirement. From a financial point of view, the most promising developers are municipalities and investor-owned utilities. In the year 2000, it may be feasible to develop sites costing approximately double the present costs. Small-scale hydropower will generally be developed now only if developers are willing to accept risks. The inflationary effects of licensing and the complexity of the process might be the major disincentives associated with licensing.

### 1306 Environmental Aspects

*REFER ALSO TO CITATION(S) 22599*

## 14 SOLAR ENERGY

*REFER ALSO TO CITATION(S) 22166, 22601*

21736 **(DOE/CS/30278—T4) Interstate Solar Coordination Council. Final report.** (Florida Solar Energy Center, Cape Canaveral (USA)). 15 Feb 1981. Contract FC02-79CS30278. 101p. (FSEC-CR—81014(DO)). NTIS, PC A06/MF A01.

The ISCC program accomplishments and future plans are reported as follows: overall activities; development of a national standards and certification program for solar collectors; develop-

ment of a national organization for operating the collector certification program; review of applicability and use of solar collector rating procedures; development of a program for evaluation/testing/certification of solar systems; development of ISCC as a formal and independent organization; development of sizing and installation manual; and coordination efforts with other solar groups. (MHR)

**21737 (DOE/EIA/10189—T1) Solar diffusion in California: a pilot study. Consultant report.** Rogers, E.M.; Leonard-Barton, D.; Avi-Itzhak, T.; Rosa, E.; Adhikarya, R. (Stanford Univ., CA (USA). Inst. for Communication Research). Oct 1979. Contract FG01-79EI10189. 159p. (P—500-79-014). NTIS, PC A08/MF A01.

Solar system owners and their neighbors in the San Francisco Bay Area were studied. The study determined the level of homeowner awareness about residential solar energy systems, described characteristics of consumers purchasing solar equipment (e.g. whether they represent identifiable market segments), identified major channels of communication through which solar information is effectively used, determined remaining barriers to solar use, identified needed incentives to accelerate commercialization, and assessed public attitudes toward various state and Federal government actions to increase the rate of solar energy use statewide. Issues and questions explored are being used in the development of a statewide survey of 700 homeowners in California to determine if these findings apply to residents throughout the state.

**21738 (DOE/EIA/10189—T3) California solar energy study: decision-analysis panel report.** Margolin, J.B.; Misch, M.R. (George Washington Univ., Washington, DC (USA). Behavioral Studies Group). Sep 1979. Contract FG01-79EI10189. 43p. NTIS, PC A03/MF A01.

In order to investigate motivations behind an individual's decision to purchase or not to purchase a solar energy system for a home, the California Energy Commission initiated a comprehensive survey program to analyze, in some depth, attitudes toward solar energy use. As part of that program, the CEC contracted for a series of panels comprised of homogenous groups of individuals who were not solar adopters, to probe for underlying attitudes about solar and, through the group dynamics process, elicit information which generally cannot be obtained using a standard questionnaire. The results shed additional light on consumer perceptions about the energy situation, the solar industry, economics, government's role and acceptance of the technology which, in turn, affect the individual's decision to adopt or not to adopt a solar energy device.

**21739 Solar training for women, a feminist perspective.** McCormick, A. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 782-784(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The WESTCAP - SUEDE (Wis.) Solar Installer Training Program employed CETA trainees for nine months of classroom and on-the-job experience with low cost solar installations. Ten (40%) of the twenty four trainees were women. the project utilized many specific techniques to meet the special needs of the women trainees. These techniques included: 1. a special women's conference for recruiting women into the probram, 2. the choice of working on mixed crews or all women construction crews, 3. placement of women in a private sector interships during the program. Each internship lead to a job offer. All the placement and production goals (60 systems) were met and two alternative-style (co-op) businesses were spin offs of the program. Various curriculum materials, including color slides, remain to document the experience of the Wisconsin SUEDE women.

**21740 Passive systems, physics, socio-economics, solar radiation, wind power.** Franta, G.E.; Glenn, B.H. (eds.). Contract AC02-77CH00178. Newark, DE; International Solar Energy Society, Inc. (1980). 870p. (CONF-800604—P3). NTIS, PC A99/MF A01.

From American section of the International Solar Energy Society conference; Phoenix, AZ, USA (2 Jun 1980).

Separate entries were made in the data base for 151 of the 169 papers presented; 18 of the papers were previously included in the data base and can be located in the report number index by report number CONF-800604. (WHK)

## 1401 Resources And Availability

**21741 (SOLAR/0010—81/04) April 1981 environmental data for sites in the National Solar Data Network.** Longnecker, A.A. (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). Apr 1981. Contract AC01-79CS30027. 185p. NTIS, PC A09/MF A01.

Environmental data collected from solar energy systems in residential and commercial buildings are tabulated for solar sites in the Network for which data are found to be valid. The sites are grouped in 12 zones. Available meteorological data are provided for insolation, temperature, wind speed and direction for all passive and some active solar sites, and humidity. The pyranometers used to measure insolation, the resistance temperature detectors, wind sensors, and humidity sensors are described, and the way data were taken is discussed. (LEW)

**21742 Actinometric measurement of solar ultraviolet.** Laue, E.G.; Gupta, A. (Jet Propulsion Lab., Pasadena, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1104-1108(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

O-nitrobenzaldhyde (NBA) and aminotriphenylamine actinometers provide a simple, reliable method of integrating solar ultraviolet irradiance. To achieve 30 days of continuous exposure it is necessary to attenuate the incident solar ultraviolet by a factor of $10^{-4}$ for the NBA actinometers. The Wratten No. 8 film filter (Kodak) is found to provide the necessary attenuation. This filter is sufficiently stable to withstand this exposure period without significant degradation. The spectral sensitivity of aminotriphenylamine actinometers increases by a factor of $10^3$ from 400 to 280 nm, and an attenuation factor of only $10^{-3}$ would be required for a 30 day exposure to the solar ultraviolet. The spectral sensitivity of these actinometers, their response linearity ranges, and the design and operation of devices suitable for field installation are reported.

**21743 Seasonal variation in the solar spectrum.** Spencer, D.W.; Healey, J. (State Univ. of New York, Albany). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1410-1414(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

One minute data from 423 consecutive days is used to measure the seasonal solar spectrum variations. The parameters measured are horizontal global irradiation with WG7, OG1, RG2, RG8 and uv filters and direct normal radiation. An average ratio of each filtered horizontal global to the clear filter is computed for each day using a least square correlation. The correlation coefficient adds information about the variability of the ratio during the day. The variability of these ratios is much higher in winter than summer, for cloudy vs. sunny days, and humid days vs. dry days. The effects of optical air mass is inferred by the study of two very clear days. The effect of water vapor is inferred from the summer relative increase in the OG1-RG2 band. The uv radiation is much lower for the 1979-80 winter than the 1978-79 winter.

**21744 Solar radiation modeling and comparisons with current solar radiation models.** Mujahid, A.; Turner, W.D. (Univ. of Arkansas, Fayetteville). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1415-1419(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Solar radiation models which can be used to predict global radiation from cloud cover data, and direct normal radiation from measurements of global have been developed for Blytheville, Arkansas. These models are compared to the current NOAA models used in the SOLMET weather tapes. The accuracies of the NOAA cloud cover model and the Randall and Whitson direct normal model are compared to recorded solar data in both Blytheville and Houston, TX. The results indicate good accuracy for the models in terms of yearly predictions, but the Randall and Whitson direct normal model, particularly, is subject to very large (+-20%) variations from month to month.

21745 **Basis and effects of inaccuracies in diffuse radiation correlations.** Erbs, D.G.; Stauter, R.C.; Duffie, J.A. (Univ. of Wisconsin, Madison). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1429-1433(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Recent hourly pyranometer and pyrheliometer data, recorded at 4 US locations, have been used to develop two different types of correlations for the diffuse radiation fraction. These correlations are compared to the data base from which they were derived, to each other, and to existing diffuse fraction correlations. All of the correlations investigated exhibit considerable scatter; accurate cloud cover data are required to further reduce the scatter in diffuse fraction correlations. TRNSYS simulations are employed to determine the effect of using different types of diffuse radiation correlations on the calculated performance of solar energy systems.

## 1403 Economics

*REFER ALSO TO CITATION(S) 21837*

21746 **(LA-UR—81-1201) Preliminary market potential indexing study of the United States for direct gain in new single-family residential construction.** Robson, W.M.; Roach, F. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810509—30). NTIS, PC A02/MF A01.

From Annual conference of the International Solar Energy Society; Philadelphia, PA, USA (26 May 1981).

The evaluation of the market potential for passive solar designs in residential new construction offers an attractive counterpart to the numerous market penetration assessments that have been performed over the last four years. Market penetration analyses have generally concerned themselves with the long run adoption of solar energy technologies, while Market Potential Indexing (MPI) addressed here examines the near-term attractiveness of solar. The MPI method is briefly reviewed, followed by specification of six attributes that may characterize the residential single-family new construction market. Raw attribute data for each of the six is presented for 220 regions within the United States. Attribute weighting functions are constructed from the perspective of consumers, producers or home builders, and the federal government. Preliminary results from these three perspectives are portrayed for a fixed sized direct gain design.

21747 **(SAND—81-0048) Incentives for solar energy in industry.** Bergeron, K.D. (Sandia National Labs., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01.

Several issues are analyzed on the effects that government subsidies and other incentives have on the use of solar energy in industry, as well as on other capital-intensive alternative energy supplies. Discounted cash flow analysis is used to compare tax deductions for fuel expenses with tax credits for capital investments for energy. The result is a simple expression for tax equity. The effects that market penetration of solar energy has on conventional energy prices are analyzed with a free market model. It is shown that net costs of a subsidy program to the society can be significantly reduced by price. Several government loan guarantee concepts are evaluated as incentives that may not require direct outlays of government funds; their relative effectiveness in achieving loan leverage through project financing, and their cost and practicality, are discussed.

21748 **Economics of electric utility backup for solar heating and hot water.** Davitian, H.; Bright, R. (Brookhaven National Lab., Upton, NY). Contract AC02-76CH00016. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1231-1235(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The long-run incremental cost (LRIC) of providing solar heating and hot water systems is estimated using a utility capacity expansion model. All investment, fuel and operating costs are accounted for. Hourly solar data are used to properly model variations in solar input. Hot water systems and combined heating and hot water systems are analyzed separately. It is found that the LRIC for solar backup is no more than the LRIC of electricity used for purely electric heating and hot water devices and also no more than the average cost of residential electric service. For the three utilities studied, there appears to be little basis for rate distinctions between solar devices using electric backup and pure electric heating and hot water devices. Off-peak storage heating and hot water devices have a much lower LRIC than the standard systems; again, there appears to be no basis for distinguishing between solar and electric off-peak devices. Compared to average cost pricing, incremental cost pricing offers considerable benefits to customers using solar and electric heat and hot water, especially if a separate lower rate is adopted for off-peak storage devices; these benefits can amount to several hundred dollars per year. Substantial savings in the use of oil and gas fuels can be achieved if residences using these fuels convert to solar systems, savings not necessarily achievable by a shift, instead, to electric systems.

21749 **Economics of solar energy systems: short term costing.** Klee, H. (Univ. of Central Florida, Orlando). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1252-1256(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Life-cycle cost analysis is traditionally used by advocates of solar energy systems to demonstrate how future increasing annual fuel savings offset the large initial capital expenditure. Payback period and return on investment are cited as proof of the economic desirability of investing in solar. Solar economics based on life-cycle costs is refuted as both imaginary and irrelevant. Predicting rates of inflation and fuel escalation, expected life, maintenance costs, and legislation over the next ten to twenty years is pure guesswork. Furthermore, given the high mobility level of the US population, the average consumer is skeptical of long run arguments which will pay returns only to the next owners. In the short-term cost analysis, the house is sold prior to the end of the expected life of the system. The cash flow of the seller and buyer are considered. All the relevant factors, including the Federal tax credit and the added value of the house because of the solar system are included.

## 1404 Environmental, Legal, And Institutional Aspects

*REFER ALSO TO CITATION(S) 21812, 21902*

21750 **Capturing the sun's energy: opportunities for local governments.** Sacramento, CA; SolarCal ([nd]). 110p. (NP—1902509).

Public policy options available to local decision makers are outlined and important and innovative actions taken by cities and counties are described. Ordinances on solar water heating, energy conservation, county pool heating, clotheslines, energy audits, shading, and solar rights are discussed. Some texts of the ordinances are presented. Planning for solar access, an incentive point system to encourage energy conservation in land planning, and processing developments utilizing solar energy systems are also discussed. (MCW)

21751 **(DOE/ER/10160—T3) SPS susceptible-system cost factors investment summary and mitigation-cost-increment estimates.** Morrison, E.L. (Department of Commerce, Boulder, CO (USA). Inst. for Telecommunication Sciences). May 1980. Contract AI01-80ER10160. 13p. NTIS, PC A02/MF A01.

The Electromagnetic Compatibility (EMC) evaluation program supporting the SPS Concept Development Evaluation Phase has included examinations of the degradation in capability of all susceptible communications and electronic systems that could be exposed to SPS emissions, the development and testing of mitigation techniques to allow operation in the SPS environment, and the development of total investment and mitigation cost data. Mitigation costs relate only to the modification or reconfiguration of susceptible systems; redeployment being a possible consideration for rectenna siting exercises during the SPS Engineering Development Phase. An extensive survey is summarized regarding the current and planned facilities using the equipment categories listed: micro-

wave communications; radar systems; sensors; computers; medical equipment; and research support. Current investment, future plans, and mitigation costs are presented, with geographic distribution in six CONUS areas.

**21752 (LA-UR—80-3095) SPS ionosphere/microwave beam interactions: Arecibo experimental studies.** Duncan, L.M. (Los Alamos Scientific Lab., NM (USA)). Oct 1980. Contract AI01-80ER10160. 29p. NTIS, PC A03/MF A01.

The purpose of this program is to determine the environmental impacts associated with the operation of the proposed SPS microwave power transmission system. It is expected that thermal effects will provide the dominant force driving the nonlinear ionosphere/microwave beam interactions. Collisional damping of radio waves, producing ohmic heating of the ionospheric plasma, depends inversely on the square of the radio wave frequency. Therefore, equivalent heating and equivalent thermal forces can be generated at lower radiated power densities by using lower radio wave frequencies. This principle is fundamental to a large part of the experimental program. An understanding of the physics of the specific interactions excited by the SPS microwave beam is also an important part of the assessment program. This program is designed to determine instability thresholds, the growth rates and spatial extent of the resultant ionospheric disturbances, and the frequency and power dependences of the interactions. How these interactions are affected by variations in the natural ionospheric conditions, how different instabilities occurring simultaneously may affect each other, and how distinct microwave beams might mutually interact are studied. Status of the program is described. (WHK)

**21753 (SERI/TR—434-423) Photovoltaic commercialization: an analysis of legal issues affecting a government-accelerated solar industry.** Lamm, D. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1980. Contract AC02-77CH00178. 67p. NTIS, PC A04/MF A01.

The Photovoltaics Research, Development, and Demonstration Act of 1978 is discussed. Legal issues, including solar access, the need for performance standards, the effects of building codes on photovoltaic system use and commercialization, and manufacturer and installer performance guarantees, are examined. Electric utility policies are examined, including interconnection, and rates and legal issues affecting them. (LEW)

**21754 Experiences of residential solar energy users: a review of empirical research.** Unseld, C.T.; Farhar, B.C.; Crews, R.; Vories, R. (Solar Energy Research Inst., Golden, CO). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1188-1192(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

A review of 15 empirical studies of residential solar energy users is summarized. Findings on user satisfaction and system performance and possible reasons for evidence of lacking correlation between them are discussed. General findings are [1] systematic research on the experiences of solar users is lacking-much research remains to be done; [2] the reported overall experiences of users has been very positive; [3] user reports indicate that system performance is generally good but there is some evidence that user reports are not accurate measures of actual performance; [4] a need exists for adequate consumer protection; [5] design or installation problems are evidenced in significant numbers of early solar installations; and [6] these problems evidently are resolvable.

**21755 Conventional HVAC contractors: convincing the competition to join the solar movement.** DeAngelis, M. (Solar Energy Research Inst., Golden, CO). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1257-1261(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The contractors who currently sell and install conventional space and water heaters in buildings can play an important role in increasing the market penetration of active and hybrid (combined passive/active) solar systems. The results of a project designed to learn more about the perceptions of heating, ventilating and air conditioning (HVAC) contractors regarding solar energy systems and to determine whether promotional seminars would increase their acceptance of solar energy systems are described. The development and scope of the seminars is explained, and a detailed evaluation of the project is described. An occupation profile of the seminar attendees is developed, their evaluation of the seminars is discussed, and their perceived barriers and incentives of HVAC contractors to entry in the solar market are summarized.

**21756 Consumer experience: implications for government solar policy.** Yarosh, M.M.; Connor, L.T. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1298-1302(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Studies of consumer experience to date suggest that, although early adopters profess to be well satisfied with their solar experience, major problems are present in a majority of systems. In addition, warranties, operating and maintenance instructions, and service are widely lacking or inadequate. Early adopters are either unusually committed to solar and, therefore, unwilling to be other than positive about their solar experience or are unaware of the presence of problems. Current data seems to demonstrate that, with present solar users, consumer satisfaction is a poor index of either system quality or system performance. It is stated that present government policy is proceeding without valid information on the quality and performance of privately funded solar installations in the field. It is further suggested that there appears to be a reluctance on the part of those who are promoting solar to develop such information for fear that it will deter solar commercialization. Such an approach could seriously undermine the credibility of all renewable energy product commercialization programs. Recommendations are given. (WHK)

**21757 Developing community networking utilizing the first weekly solar energy radio program.** Grundy, R.R. (College of DuPage, Glen Ellyn, IL); Perloff, S.N. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1347-1351(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The first and only one half hour radio program dealing with solar energy, Solar Encounter, WDCB 90.9 FM, Glen Ellyn, Illinois is discussed. The present format with its evolutionary changes and emphasis is developed for possible adoption and adaptation by other radio stations. Evidence that Solar Encounter serves as a focal point of information transfer and has facilitated net-working or cross-ties among mutually inclusive but disparate solar energy enthusiasts is shown. Then a discussion of why now is the time for the solar community to make itself known to the public over the airwaves is presented. Finally, there is a nationwide wrap up of present solar programming activities.

## 1405 Solar Energy Conversion

*REFER ALSO TO CITATION(S) 21722, 21729, 21730, 21732, 21734, 21825, 21829, 21836, 21932, 21940, 21977, 22311, 22626*

**21758 (CONF-810526—26(Draft)) Optical-absorption measurements of pure and heavily doped silicon from 1.24 to 4.63 eV and the effect on solar-cell performance.** Jellison, G.E.; Jr.; Modine, F.A.; White, C.W.; Young, R.T. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

The optical constants of pure and heavily doped silicon are determined between 1.24 and 4.63 eV (for pure Si) and between 1.55 and 4.13 eV (for heavily doped Si) using polarization modulation ellipsometry. This technique is very sensitive to the optical absorption coefficient ($\alpha$) above $10^4$ $cm^{-1}$; therefore, the values presented here are the best available for photon energies above 2.5 eV (or below 0.5 $\mu$m). For photon energies less than 3.4 eV it is found that heavy As doping substantially increases $\alpha$, while heavy B or P doping results in a much smaller increase in $\alpha$. The effects on solar cell quantum coefficiencies resulting from large increases in $\alpha$ are examined. By comparing theoretical calculations with experimental data, it can be concluded that the increased absorption must be due to electron-hole pair creation. The increased absorption also can reduce the blue response of cells fabricated with very heavily

doped As emitters ($>10^{20}$ As/c$^3$), if the surface recombination velocity is large, or if the emitter diffusion length is small.

**21759 (CONF-810526—27) Effect of lithium diffusion into polycrystalline Si solar cells.** Young, R.T.; Jellison, G.E.; Chang, Y.K.; Lu, M.C.; van der Leeden, G.A. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

An effort has been made to understand the role of lithium in polycrystalline Si. It was found recently that when Li was added to polycrystalline Si, it not only provided an excess free carrier for each ionized $Li^+$, but also dramatically improved the carrier mobility. The electrical transport properties of the individual grain boundaries before and after lithium diffusion have now been studied by temperature dependent resistivity measurements, which indicate that the grain boundary barrier heights can be effectively removed by lithium diffusion. However, the use of scanning laser techniques to study the influence of lithium on minority carrier recombination in the grain boundaries reveal that the recombination in most grain boundaries is not affected by lithium. This finding explains why the diffusion of lithium in polycrystalline Si solar cells does not give pronounced improvement in cell efficiencies.

**21760 (CONF-810526—28(Draft)) Pulsed-laser annealing of ion-implanted semiconducting GaAs for homojunction solar cells.** Lowndes, D.H.; Cleland, J.W.; Fletcher, J.; Narayan, J.; Westbrook, R.D.; Wood, R.F.; Christie, W.H.; Eby, R.E. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

The results of a study whose purpose was to evaluate the combination of ion implantation followed by pulsed ruby laser annealing (11/PLA), as semiconducting GaAs substrates, are reported. High dose Zn, Mg, Si, and Se implants were used. PLA was carried out in air without encapsulation, and with thin sputtered $SiO_2$ encapsulation layers. The combination of I-V, C-V, scanning electron microscopy, transmission electron microscopy, and secondary ion mass spectroscopy measurements that were carried out have important implications for photovoltaic applications including the possibility of forming planar junctions, the choice of implanted ions to obtain high electrical activation, the optimum pulsed laser energy density range, the resultant junction depth and electrical characteristics, and the presence of laser-and implantation-induced residual defects.

**21761 (DOE/ET/20071—T4) Production of sugarcane and tropical grasses as a renewable energy source. Third quarterly report, December 1, 1980-February 28, 1981.** Alexander, A.G. (Puerto Rico Univ., Rio Piedras. Center for Energy and Environment Research). 1981. Contract AS05-78ET20071. 47p. NTIS, PC A03/MF A01.

Research continued on tropical grasses from Saccharum and related genera as sources of intensively-propagated fiber and fermentable solids. Greenhouse-level screening for short- and intermediate-rotation grasses included further trials with legume species as potential nitrogen sources for the tropical grasses. Yields from four indigenous legumes were appreciably higher when planted in spring (May) than when planted in autumn (November). Initial data were recorded from second generation energy cane studies established during 1980. Controlled variables include varieties, harvest interval, and nitrogen input. Yield data at 6 months indicate high but essentially equal growth rates among all varieties and N-variables. This is attributed to the use of a land rotavator during seedbed preparation - the first such application of this implement on Lajas Valley soils. Total green weights were in the order of 50 to 60 tons/acre, and millable stem weights ranged from 33 to 37 tons/acre, at the 6-months harvest. Dry matter yields ranged from 8 to 11 tons/acre. Juice quality values indicated a minimal sugar content at this stage of maturity. Fiber values ranged from 7 to 14%. Field-scale studies were continued at the Hatillo demonstration site on the humid north coast and in the semi-arid Lajas Valley. For the 6-months harvest at Hatillo, total green weights for all treatments averaged 38.4 tons/acre. Variety US 67-22-2 produced 50.2 tons/acre. Millable cane yields averaged 25.3 tons/acre for all treatments and 34.7 tons/acre for variety US 67-22.2.

**21762 (DOE/ET/20279—134) Performance characteristics of solar-photovoltaic flywheel-storage systems.** Jarvinen, P.O.; Brench, B.L.; Rasmussen, N.E. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1981. Contract AC02-76ET20279. 6p. (CONF-810526—23). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

A solar photovoltaic energy flywheel storage and conversion system for residential applications was designed, built and tested. Performance and efficiency measurements were conducted on the system, which utilizes low-loss magnetic bearings, maximum-power-point tracking of the photovoltaic array, integrated permanent magnet motor-generator, and output power-conditioning sections of either the stand-alone cycloconverter or utility interactive inverter type. The overall in-out electrical storage efficiency of the flywheel system was measured along with the power transfer efficiencies of the individual components and the system spin-down tare losses. A round-trip storage efficiency of 82% in the utility interactive mode and 74% in the stand-alone mode was found. This compares favorably with systems involving batteries and an inverter, which typically exhibit a round trip efficiency less than 70%.

**21763 (DOE/ET/23037—2) Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979.** Paul, W. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). Jan 1980. Contract AC03-79ET23037. 21p. NTIS, PC A02/MF A01.

Analysis by Secondary Ion Mass spectrometry has shown levels of about 1000 ppM of 0 and other chemical species in our a-Si:H, which is about the same as is found in samples from other laboratories where such measurements have been carried out. There is also an increase in the level of contaminant near the substrate-film interface which is judged to be the likely cause of our hitherto low field effect response. Methods of preparation are being changed in an attempt to eliminate the contaminant. The field effect was also measured near the top surface of the samples, using a teflon insulator. Analysis of these data, following the procedures adopted by others as reported in the literature, indicates densities of states in the pseudogap as low as several times $10^{16}$ cm$^{-3}$. Such densities are comparable with the best that have been published. However, we feel that both the field effect experiment and its analysis (ours and others) are flawed by experimental errors and necessary assumptions. Efforts are being made to reduce these.

**21764 (DOE/ET/23037—3) Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, January-March 31, 1980.** Paul, W. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). Jun 1980. Contract AC03-79ET23037. 24p. NTIS, PC A02/MF A01.

The effect of a variety of plasma cleaning procedures on the level of bulk and interfacial contaminants in the films is analyzed by secondary ion mass spectrometry. Bulk levels of 0 have been reduced considerably by $N_2$ plasma cleaning, but no reproducible reductions in interfacial contamination have been achieved. A method is described of determining the gap state density $N(\epsilon)$ of a-Si:H from field effect, in which no assumptions are made about the form of the band bending in the semiconductor. The problem is reduced to three successive integrals over an assumed $N(\epsilon)$ by change of variable from distance to applied voltage and the best fit to the experimental data is obtained by iteration of the assumed state density. The method is shown to be no less rigorous and considerably more economical than the recent analysis of Goodman, Fritzsche and Ozaki. In addition, an experimental means of determining the flat-band voltage to within 5% of the maximum gate voltage V/sub g/ used is demonstrated, by finding the value of V/sub g/ for which (kT/e)dlog I/sub SD//dV/sub g/ is independent of temperature.

**21765 (DOE/JPL/954334—18) Low cost solar array project. Quarterly progress report, January-March, 1981.** (Union Carbide Corp., Sistersville, WV (USA)). 1981. Contract NAS-7-100-954334. 83p. NTIS, PC A05/MF A01.

The engineering design, fabrication, assembly, operation, economic analysis, and process support R and D for an Experimental Process System Development Unit (EPSDU) are presented. The civil construction work was completed and the mechanical bid package is in preparation. The electrical design effort is in progress. Parallel efforts which complement the mechanical design are the process flow diagrams and control instrumentation logic for startup operation and shutdown. These are in progress and will identify all process and utility streams, control systems, and flow logic. The data collection system takes the signals from the instrumentation, translates them into engineering units and finally develops a data report which summarizes all key performance parameters. Cleaning procedures have been established to assure a contamination-free product and inspection visits have been made to the fabricators of specialty equipment.

**21766 (DOE/JPL/954739—4) Study program for encapsulation materials interface for low-cost solar array. Annual report, January 1, 1980-December 31, 1980.** Kaelble, D.H.; Mansfeld, F.B.; Kendig, M.; Leung, C. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Feb 1981. Contract NAS-7-100-954739. 80p. NTIS, PC A05/MF A01.

Emphasis is placed on the development of ac impedance as a nondestructive evaluation methodology for solar arrays and the further development of corrosion models and materials selection criteria for corrosion resistant interfaces.

**21767 (DOE/JPL/954796—81/12) Analysis and evaluation in the production process and equipment area of the low-cost solar-array project. Quarterly report, July-October, 1980.** Wolf, M.; Goldman, H. (Pennsylvania Univ., Philadelphia (USA). Moore School of Electrical Engineering). Jan 1981. Contract NAS-7-100-954796. 176p. NTIS, PC A09/MF A01.

The attributes of the various metallization processes have been investigated which express themselves in economic results. It has been shown that several metallization process sequences will lead to adequate metallization for large area, high performance solar cells at a metallization add-on price in the range of $6.- to 12.-/m$^2$, or 4 to 8 cents/W(peak), assuming 15% efficiency. Conduction layer formation by thick film silver or by tin or tin/lead solder leads to metallization add-on prices significantly above the $6.- to 12.-/m$^2$ range. The wet chemical processes of electroless and electrolytic plating for strike/barrier layer and conduction layer formation, respectively, seem to be most cost-effective. Vacuum deposition of the strike/barrier layer can be competitive with electroless plating.

**21768 (DOE/JPL/955089—80/10) Silicon solar cell process development, fabrication, and analysis. Eighth quarterly report, 1 October 1980-31 December 1980.** Yoo, H.I.; Iles, P.A.; Leung, D.C. (Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.). 1980. Contract NAS-7-100-955089. 55p. NTIS, PC A04/MF A01.

Work included fabrication and characterization of solar cells from heat exchanger method (HEM), Dendritic Webs, and edge defined film-fed growth (EFG) ribbons. HEM solar cells showed only slight enhancement in cell performance after gettering steps (diffusion glass) were added. Dendritic webs from various growth runs indicated that performance of solar cells made from the webs was not as good as that of the conventional Czochralski (CZ) cells. EFG ribbons grown in CO ambient showed significant improvement in silicon quality. Efforts to passivate grain boundaries (G.B.) by preferential diffusion through G.B. did not result in improvement of sheet quality. Silicon sheets in these tests included SILSO, EFG, and Poly CZ.

**21769 (DOE/JPL/955533—81/5) Development of a polysilicon process based on chemical vapor deposition (Phase 1). Fifth quarterly progress report, 1 October-31 December 1980.** McCormick, J.; Sharp, K.; Arvidson, A.; Sawyer, D. (Hemlock Semiconductor Corp., MI (USA)). Mar 1981. Contract NAS-7-100-955533. 38p. NTIS, PC A03/MF A01.

The goal of this program is to demonstrate that a dichlorosilane-based reductive chemical vapor deposition (CVD) process is capable of producing, at low cost, high quality polycrystalline silicon. Physical form and purity of this material will be consistent with LSA material requirements for use in the manufacture of high efficiency solar cells. Experimental data generated by Hazards Research Corp. indicate that the ease of ignition and explosion severity of dichlorosilane (DCS)/air mixtures in substantially attenuated if the DCS is diluted with hydrogen. DCS/hydrogen mixtures will accordingly be transported in preference to transfer or storage of pure DCS. Redesign of the PDU (Process Development Unit) to accommodate new safety-related information is complete. All major process equipment has been ordered, and construction of the facility is underway, with startup scheduled for June 1981. Similarly, a feed system to supply an intermediate sized reactor from purchased DCS cylinders has been extensively redesigned. System construction is in progress, with completion targeted from March 1981. Several different sources of trichlorosilane were used to generate a mixture of redistributed chlorosilanes via Dowex ion exchange resin. The unseparated mixtures were then fed to an experimental reactor in which silicon was deposited and the deposited silicon analyzed for electrically active impurities. At least one trichlorosilane source provided material of requisite purity for PDU integration with the existing HSC recovery system. Silicon grown in the experimental reactor from commercially purchased DCS was converted to single crystal material and solar cells fabricated. Cell efficiencies met or exceeded baseline cell efficiencies.

**21770 (DOE/JPL/955699—81/03) Process development for automated solar-cell and module production. Task 4. Automated array assembly. Quarterly report No. 3.** Hagerty, J.J.; Gifford, M. (Tracor MBA, San Ramon, CA (USA)). 15 Apr 1981. Contract NAS-7-100-955699. 32p. NTIS, PC A03/MF A01.

The Automated Lamination Station is mechanically complete and is currently undergoing final wiring. The high current driver and isolator boards have been completed and installed, and the main interface board is under construction. The automated vacuum chamber has had a minor redesign to increase stiffness and improve the cover open/close mechanism. Design of the Final Assembly Station has been completed and construction is underway.

**21771 (DOE/JPL/955733—80/1) Development of advanced Czochralski growth process to produce low-cost 150-kg silicon ingots from a single crucible for technology readiness. First quarterly progress report, October 1, 1980-December 31, 1980.** (Kayex Corp., Rochester, NY (USA)). 1980. Contract NAS-7-100-955733. 15p. NTIS, PC A02/MF A01.

Design, release for manufacture, and procurement of a modified CG2000 RC crystal grower proceeded. The construction, installation, and test of this machine is expected by March 1, 1981. The process development work will begin when the grower is completed. All of the hot zones, polycrystalline silicon, crucibles, dopant, seeds, and other supplies were quoted and purchase orders issued. Several exhaust gas analysis system equipment specifications and quotations were received and are under study. Process control requirements have been defined and design work on the melt temperature, melt level and continuous diameter control begun. Sensor development included assembly and testing of a bench prototype of a diameter scanner system.

**21772 (PNL-SA—9464) Photovoltaics.** Garnier, J.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 31p. NTIS, PC A03/MF A01.

A set of drawings, graphs, and brief notes outline the theory of solar cells and the national photovoltaic program. (LEW)

21773 **(SAND—80-0216) Implementation plan (May 1979): batteries for specific solar applications.** Clark, R.P. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01.

The scope and objectives of the Batteries for Specific Solar Applications Project (BSSAP) are discussed. The BSSAP consists of five major tasks: Battery Requirements Analysis, Laboratory Evaluation, Photovoltaic Advanced Systems Tests, Photovoltaic Applications Experiments, and Battery Research and Development. All five tasks are described, and the schedule and milestones for completing each task are listed. Requirements for annual reporting and reviews are specified, and the BSSAP is linked with the existing Sandia/DOE PV Project.

21774 **(SAND—80-2206C) Interdigitated back contact solar cell with high-current collection.** Garner, C.M.; Nasby, R.D.; Sexton, F.W.; Rodriguez, J.L.; Norwood, D.P. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 8p. (CONF-810526—13). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

Internal current-collection efficiencies greater than 90 percent and energy-conversion efficiencies of 18 percent at 30 suns have been measured on a laboratory version of the interdigitated back contact (IBC) solar cell. The quantum efficiency at 600 nm was greater than 90 percent which implies a minority carrier lifetime of greater than 350 μsec and a front surface recombination velocity of less than 30 cm/sec on the better devices. To achieve these high-current collection efficiencies, a phosphorous gettering diffusion was performed on the front surface and then etched off. Also, thermal oxides were grown on the front and back of the cell to passivate the silicon surfaces. Although the internal collection efficiencies of the cell were high, series resistance caused the fill factor (FF) to decrease at concentrations above 30 suns. Dark current measurements on cells with a new grid spacing indicate that the series resistance is much lower than in the previous cell design. This should result in higher efficiencies at high concentration.

21775 **(SAND—81-0069) Cell string model with mirror gap shading for a parabolic-trough photovoltaic collector.** Burns, J.R.; Edenburn, M.W. (Texas Tech Univ., Lubbock (USA); Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 44p. NTIS, PC A03/MF A01.

A model is described of a photovoltaic cell string which is illuminated by a parabolic trough reflector. The model shows what effect reflector gaps have on cell illumination and how this effect influences shunting of dioded strings for various angles of solar incidence. The model was formulated to study diode string length and determine how best to maximize power under variant incidence angles. Qualitative results suggest that a nonuniform dioding arrangement would minimize power losses due to shunting; that small strings should be used where shading is most probable; and, for north-south axis collectors, that the receiver should be moved northward to avoid end losses and end shading of the receiver.

21776 **(SAND—81-1145C) Real-time performance testing of photovoltaic-concentrator modules.** Pritchard, D.A. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810526—11). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

A description of the resources at the Photovoltaic Advanced Systems Test Facility (PASTF) is presented. These resources include a multi-level data acquisition system for collector module performance testing, associated user-interactive software for accomplishing these tests, and extensive support hardware. A group of standard tests has been developed for module characterization. Descriptions of these tests and sample results for a variety of module designs are also presented.

21777 **(SAND—81-1191C) Compatibility of Fresnel lenses and photovoltaic cells in concentrator modules.** Stillwell, C.B.; Shafer, B.D. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-810526—25). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

Test data are used to compare, for point focus photovoltaic concentrator modules, the relationship between Fresnel lens and module efficiency. The data shows that lenses designed for maximum optical efficiency may not produce the maximum module efficiency. Lenses designed with consideration for the photon flux distribution on the solar cell may improve module efficiency possibly at some loss in lens optical performance.

21778 **(SAND—81-1211C) Photovoltaic concentrator technology.** Boes, E.C.; Shafer, B.D. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 6p. (CONF-810526—21). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

The most significant of the recent advances in the development of concentrating photovoltaic collectors are described. Highlights are: (1) in moderate volume production ($10^5$ $m^2$ per year), current designs could be sold for $3.70 to $5.20 per annualized peak watt, completely installed; (2) several array designs have annual efficiencies of 10 to 13%, developmental have achieved 16%; (3) concentrator Si cells have been tested above 20% at 27°C and 50X.

21779 **(SAND—81-1222C) Overview: recent developments and potential of photovoltaic concentrating collectors.** Schueler, D.G. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810526—19). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

Significant progress has been made in the definition and development of technology for low cost photovoltaic concentrating collectors. At this time, the most promising candidate approaches are point-focus and linear-focus Fresnel lens designs using silicon solar cell technology and two axis tracking. Incremental improvements in these base-line designs are expected to ultimately lead to cost-effective photovoltaic collector subsystems. This paper reviews and summarizes recent developments in photovoltaic concentrator technology with respect to its long-range economic potential.

21780 **(SAND—81-7113C) Low-cost, actively-cooled linear photovoltaic receiver.** Shepard, N.F. Jr. (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). 1981. Contract AC04-76DP00789. 20p. (CONF-810526—14(Draft)). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

The development of a novel receiver design for a linear focus concentrator is discussed. This design concept, which employs a pair of nested glass tubes, offers the potential for low-cost production through reduced material content and design simplicity. A specially configured inner borosilicate glass tube functions as the mounting surface for the solar cell circuit in this dual focus receiver geometry. This inner tube, which is capped at each end to provide an interior dead air space, is inserted within a 2 inch ID glass pipe which is part of the Corning Pyrex beaded pressure process piping system. The selected receiver coolant, which is designated as Synfluid (2 centistokes kinematic viscosity), is circulated through the outer glass pipe in direct contact with the solar cell circuit active area. The concentrated irradiance from the parabolic trough impinges on the outer glass pipe and is optically transmitted through the clear synthetic mineral oil to the solar cell circuit. A prototype receiver of this design has been installed in a parabolic trough and subjected to a series of characterization tests to evaluate both thermal and electrical performance.

**21781 (SERI/PR—8041-16-T1) Feasibility study of a microwave application for solar-cell fabrication. Annual report for period ending February, 1981.** Chitre, S.; Olson, C. (Photowatt International, Inc., Tempe, AZ (USA)). Mar 1981. Contract AC02-77CH00178. 49p. NTIS, PC A03/MF A01.

An investigation of the application of microwave energy in heating for junction formation, back surface field formation, metallization sintering, and combinations of these operations is presented. During the initial phases the product produced did not conform to the theoretical predictions and as a result, a mathematical model was generated and a computer analysis made. The initial expectations are outlined in Section 2 and the model and results of the computer analysis are reported in Section 3. Two generations of equipment were designed and a third one is underway. The first instrument was not capable of uniformly heating wafers above 600°C, but this was rectified in the second instrument which utilized a mixed mode, multiple pass cavity. A discussion of the results of experiments on sintering, diffusion, BSF formation, and simultaneous front and back surface junction formation is presented with a tabular summary. The overall results were encouraging with particularly encouraging results on the simultaneous BSF and front junction formation. In spite of a very low fill factor (0.67) the efficiency of the cells averaged 9.8% with a maximum of 10.7.

**21782 (SERI/PR—8063-1-T1) Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, March 1-June 1, 1979.** (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Aug 1979. Contract AC02-77CH00178. 66p. NTIS, PC A04/MF A01.

Progress has been made on improving the photon efficiency of the planar CdS/$Cu_2$-S solar cell. Currents in excess of 20 mA/$cm^2$ have been achieved. Mixed sulfide solar cells responsive to heat treatment are now being produced. The morphology of the $Cu_2S$/CdZnS junction has been examined and found to be significantly different than the morphology on CdS/$Cu_2S$ cells. Efficiencies measured under ELH simulation approaching 8% have been achieved. Work in the analytical task has focused on establishing the experimental techniques to study the trap levels in the CdS and to provide a working model for the voltage instabilities in some (CdZn)S/$Cu_2S$ cells. Cells under roof top exposure continue to be monitored.

**21783 (SERI/PR—8063-1-T3) Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, December 1, 1978-March 1, 1979.** (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Aug 1979. Contract AC02-77CH00178. 35p. NTIS, PC A03/MF A01.

The development of the planar junction CdS/$Cu_2S$ solar cell has been continued. Experiments have been conducted with varying thicknesses of $Cu_2S$ to determine whether the need for light trapping can be reduced by utilizing thick $Cu_2S$ layers. Further optical analysis of the influence of texturing on light trapping in the cell have been conducted. In the development of a (CdZn)S/$Cu_2S$ cell, a major effort has been expended in determining the details of the junction morphology. A wide range of analytical work has continued. Preliminary data has been obtained on cells sealed behind sheet glass and cells with integral electron beam evaporated glass coatings.

**21784 (SERI/PR—8063-1-T4) Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, September 1-December 1, 1978.** (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Jun 1979. Contract AC02-77CH00178. 54p. NTIS, PC A04/MF A01.

The CdS/$Cu_2S$ cell development effort was directed toward the planar junction cell. This junction gives a higher open circuit voltage than that achieved with the highly textured cell structure. Optical measurements have shown that applying a two-layer antireflection coating to the planar cell does not achieve the high photon economy shown by the textured structure. Total reflectance measurements have revealed that this is due to the lack of light trapping in the planar structure. Modified cell designs are now being developed with the planar junction necessary for high open circuit voltage while achieving the necessary light trapping. Work on the (CdZn)S/$Cu_2S$ cell has revealed that cell performance is extremely sensitive to the method of $Cu_2S$ producton. Appropriate structural studies have been initiated to identify the underlying reasons. Theoretical analysis and modeling of the current flow in the $Cu_2S$ layer has shown that the conventional one-dimensional analysis can lead to significant errors in interpreting the effects of sheet resistance. A rigorous two-dimensional current analysis is being conducted. The importance of the changes in absorption coefficient of the $Cu_2S$ stoichiometry has been identified and the relation between stoichiometry, resistivity, and absorption coefficient derived. On the basis of a review of the encapsulation task in the large scale silicon array program it has been determined that inorganic glasses are probably the only viable encapsulant for a CdS/$Cu_2S$ cell.

**21785 (SERI/PR—8309-1-T4) Cadmium sulfide-copper sulfide heterojunction cell research. Annual report, September 1, 1979-August 31, 1980.** (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Dec 1980. Contract AC02-77CH00178. 107p. NTIS, PC A06/MF A01.

The primary goal of this program, increasing the conversion efficiency of a thin-film cell based on CdS/$Cu_2S$, has been achieved. A number of (CdZn)S/$Cu_2S$ cells have been made with conversion efficiencies in excess of 10% when tested in collimated sunlight. The highest efficiency achieved was 10.2% for a cell with 16% Zinc which had the following parameters; V/sub oc/ = 0.60V, J/sub sc/ = 22.8 mA/$cm^2$ (pro-rated to 100 mW/$cm^2$) FF = 74.9%. Further improvement in the performance of CdS/$Cu_2S$ cells beyond the previously reported 9.2%, was found to be limited by deficiencies in the fundamental knowledge and control of the $Cu_2S$ layer. A number of process changes in the production of CdS/$Cu_2S$ cells have been explored and are reported on. Transient capacitance measurements on CdS/$Cu_2S$ cells and further development of an integral encapsulation are also reported.

**21786 (SERI/PR—9190-1-T1) Investigation of solar cells based on $Cu_2O$. Progress report, June 1, 1980-November 30, 1980.** Olsen, L.C. (Joint Center for Graduate Study, Richland, WA (USA)). Feb 1981. Contract AC02-77CH00178. 34p. NTIS, PC A03/MF A01.

Progress was made in three areas: microstructure of $Cu_2O$ substrates; correlation of $Cu_2O$ microstructure with Cu/$Cu_2O$ cell properties; and in fabrication of Tl/$Cu_2O$ Schottky barriers. Characterization of $Cu_2O$ substrates with IMMA indicates that Cl is uniformly distributed through grains, Mg precipitates at grain boundaries and Na and Fe precipitates occur throughout the material. It is clear that the presence of Cl results in lower p-type resistivities. Previous photoresponse scans established that grain boundaries are not significantly active concerning minority carrier recombination. I-V analyses of Cu/$Cu_2O$ cells indicate that leakage current components are a result of distributed effects, and not a grain boundary mechanism. It is not yet clear whether the distributed effects are strictly a surface effect, or a result of bulk defects such as Na and Fe precipitates. Tl/$Cu_2O$ Schottky barrier studies are progressing well. This device structure is being used as a means of determining if a significant built-in voltage can be achieved with a $Cu_2O$ cell. Problems were encountered concerning deposition of thin Tl films. The films tend to agglomerate. Substrates will be cooled to counter the apparent lateral diffusion. V/sub oc/ values greater than 0.6 volts were obtained with thick film Tl/$Cu_2O$ cells, however. These results suggest an improved built-in potential was achieved.

**21787 (SERI/PR—9219-T1) Sputtered amorphous silicon solar cells. Quarterly report No. 2, October 22, 1980-January 22, 1981.** Moustakas, T.D.; Morel, D.L.; Wronski, C.R. (Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.). 1981. Contract AC02-77CH00178. 41p. NTIS, PC A03/MF A01.

The mechanism of hydrogen incorporation during the film growth was investigated through hydrogen content studies. The data are consistent with a kinetic model of hydrogen incorporation. The hole mobility-lifetime products were measured on a-SiH/sub x//metal Schottky barrier structures with a new method utilizing optical absorption, collection efficiency, and capacitance voltage measurements. The diode properties of reactively sputtered hydrogenated amorphous silicon Schottky barrier structures (a-SiH/sub x//Pt) were investigated as a function of hydrogen content. The data are interpreted in terms of hydrogen modification of the va-

lence band edge and interfacial oxide effects. The fabrication by the method of sputtering of P-I-N/ITO solar cell structures is reported. (MHR)

21788 **(SERI/PR—9234-2-T1) Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells. Quarterly technical progress report No. 2, 1 November 1980-31 January 1981.** Sopori, B.L. (Motorola, Inc., Phoenix, AZ (USA). Solar Energy Dept.). 29 Aug 1981. Contract AC02-77CH00178. 44p. NTIS, PC A03/MF A01.

Results described in this report clearly indicate that high quality small area diodes can be fabricated with negligible edge effects. It is shown that these devices can be used to determine carrier transport mechanisms, which, in turn, are related to the nature of defects present in the substrate. The sectioning technique, in conjunction with other techniques described previously, enables a detailed analysis of the nature of defects (and their propagation paths). A unified approach towards applications of a two-wavelength laser scanner for photovoltaic material/device characterization is discussed in the appendix.

21789 **(SERI/PR—9237-1-T2) Amorphous thin films for solar-cell applications. Technical progress report, 11 October 1980 to 15 January 1981.** Jonath, A.D.; Anderson, W.W.; Crowley, J.L.; MacMillan H.F. Jr.; Thornton, J.A. (Lockheed Missiles and Space Co., Palo Alto, CA (USA). Research Labs.). 20 Feb 1981. Contract AC02-77CH00178. 26p. NTIS, PC A03/MF A01.

Progress has been ahead of planned expectations in three instances: (a) achievement of 4 $mA/cm^2$, short circuit current density in a MIS structure solar cell under AM1 illumination; (b) fabrication of large area (4 $cm^2$) MIS cells with external J/sub sc/ $> 3$ $mA/cm^2$; and (c) deposition of $p^+$ layers by $B_2H_6$ gas phase doping. A program status table is included. Reproducible n layers are now routinely deposited by sputtering in Ar, $H_2$, and $PH_3$ gases. The major remaining obstacle to the goal of a 3.5% cell is the deposition of a quality i-layer. Although information deduced from infrared absorption and Raman data indicates that most of the hydrogen is bonded in the SiH configuration, the photoconductivity of the intrinsic material requires marked improvement. Two forms of magnetron sputtering, planar and cylindrical, are being exploited. The planar deposition system has the advantage that experimental costs are low; the cylindrical system is easily scalable to large product throughput. Schematic illustrations of the two systems and descriptions of apparatus modifications incorporated are included.

21790 **(SERI/PR—9354-T1) InP single-junction concentrator cell. Semi-annual report, October 1, 1980-March 31, 1981.** Gregory, P.E. (Varian Associates, Palo Alto, CA (USA). Solid State Lab.). 1981. Contract AC02-77CH00178. 42p. NTIS, PC A03/MF A01.

The purpose of this work is to develop a glass-sealed back-contacted InP or InGaAsP solar cell for use in concentrator systems. Work to be performed in developing this cell includes growing the InP epitaxial layers needed for cells and test structures, developing a model to be used in optimizing the cell structure, measurement of InP parameters necessary for use in the model, and developing the glass-bonding and back-contacting scheme. Accomplishments in these areas are discussed.

21791 **(SERI/PR—9372-1-T1) Amorphous silicon solar cells. Quarterly report No. 1, 1 October 1980-31 December 1980.** Carlson, D.E.; Balberg, I.; Crandall, R.S.; Dresner, J.; Goldstein, B.; Hanak, J.J.; Schade, H.E.; Staebler, D.L.; Weakliem, H.A. (RCA Labs., Princeton, NJ (USA)). Feb 1981. Contract AC02-77CH00178. 84p. NTIS, PC A05/MF A01.

Progress is reported on the following: theoretical modeling, deposition and doping studies, experimental methods for the characterization of a-Si:H, formation of solar-cell structures, theoretical and experimental evaluation of solar-cell parameters, and stability studies. (MHR)

21792 **(SERI/PR—80062-1-T1) $Zn_3P_2$ as an improved semiconductor for photovoltaic solar cells. Eighth quarterly report, June 1-August 31, 1980.** (Delaware Univ., Newark (USA). Inst. of Energy Conversion). 1980. Contract AC02-77CH00178. 38p. NTIS, PC A03/MF A01.

The diffusion coefficient of magnesium in $Zn_3P_2$ has been determined by two methods: (1) from the rate of decrease of the quantum efficiency at short wavelengths; and (2) from the location of the EBIC response maxima in cleaved junctions. The diffusion coefficient of magnesium ranges from $4.9 +- 1.6.10^{-10}$ $cm^2$/min determined by EBIC measurements to $1.7.10^{-10}$ $cm^2$/min from spectral response measurements. The values of n and k of thin (60 to 150 A) magnesium films has been measured over a range wavelengths. This will enable adequate modeling of single and multiple layer AR coatings in the future. The heating of magnesium contacts on $Zn_3P_2$ has the effect of reversing grain boundary recombination and leads to enhanced output at the boundary. EBIC measurements show a higher output at grain boundaries after heating at 100°C for 94 minutes. The V/sub oc/ of ZnO/$Zn_3P_2$ devices exhibits a non linear dependence on ln J/sub sc/ at high current levels suggesting photo current suppression. Thin $Zn_3P_2$ flms were prepared on carbon coated 3% Si-Fe in an attempt to lower R/sub s/ x A and improve device efficiency. Although the new substrate results in lower R/sub s/ x A and high short circuit currents are obtained, the open circuit potential is reduced and the overall conversion efficiency is the same as devices prepared on Fe/C coated mica. (WHK)

21793 **(SERI/TP—612-1190) MIS silicon solar cells: potential advantages.** Cheek, G.; Mertens, R. (Solar Energy Research Inst., Golden, CO (USA)). May 1981. Contract AC02-77CH00178. 6p. (CONF-810526—10). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

Recent progress with silicon solar cells based on the MIS or SIS structure is reviewed. To be competitive with pn junction technology in the near term, these cells must be much cheaper or have a higher efficiency in a production environment. Apparently, the minority carrier MIS cells have the greatest potential for large-scale applications. The data currently indicate that all types of MIS/SIS cells have some inherent instability problems.

21794 **(SERI/TR—8063-1-T2) Cadmium sulfide-copper sulfide heterojunction cell research. Final report, September 1, 1978-August 31, 1979.** (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Dec 1979. Contract AC02-77CH00178. 127p. NTIS, PC A07/MF A01.

Research on the planar CdS/$Cu_2S$ cell to increase the short circuit currents to the levels achieved with the 9.15% textured cell is given. It was established early in the contract that light trapping is essential for high currents and a front surface texturing process has been developed to achieve this. As a result, short circuit currents have been raised to over 21.0 $mA/cm^2$. The highest efficiency achieved with the planar junction cell during the contract was 7.81%. Cells heat treated to their highest short circuit currents have shown fill factors below the design requirement of about 74% thus putting a limit on achievable efficiency. Progress has been made on improving the performance of the (CdZn)S/$Cu_2S$ again with the major emphasis being on improved short circuit currents. Modifying the CdZn/S deposition procedure has resulted in considerably improved short circuit currents to over 21 $mA/Cm^2$, and a cell efficiency of 8.19% has been recorded. Fundamental studies have focused on the influence of substrate composition and heat treatment on junction field and collection efficiency. Quantitative analysis has been carried out of the optimal material parameters required to maximize energy converson efficiency. It has been shown a relatively narrow range of properties in the CdS and $Cu_2S$ is necessary to achieve the highest efficiencies. The encapsulation task has focused on trial depositions of glass applied by electron beam evaporation.

21795 **(TAC/SP—80-004) Solar photovoltaics: a bibliography with abstracts.** (New Mexico Univ., Albuquerque (USA). Technology Application Center). Apr 1981. 188p. Univ. of New Mexico, Albuquerque.

This annotated bibliography covers the following subjects: overviews; economic, legal, environmental, health, and safety aspects; cell materials, materials properties, encapsulants; cell fabrication and configuration; performance, testing, simulation, and evaluation; array types, materials, and fabrication; applications; energy storage; and satellite power stations. Both author and keyword indexes are included. (MHR)

21796 **Thin-film polycrystalline $Cu_2S$/Cd/sub 1-x/Zn/sub x/ S solar cells of 10% efficiency.** Hall, R.B.; Birkmire, R.W.; Phillips, J.E.; Meakin, J.D. (Institute of Energy Conversion, University of Delaware, Newark, Delaware 19711). *Applied Physics Letters ;* **38**: No. 11, 925-926(1 Jun 1981).

Polycrytalline, thin-film $Cu_2S$/Cd/sub 1-x/Zn/sub x/S heterojunction solar cells with conversion efficiencies of 10% have been prepared on Cd/sub 1-x/Zn/sub x/S with $0.1 < or = x < or = 0.2$. Light-generated currents of up to 26 mA/cm$^2$ (prorated to 100 mW/cm$^2$) have been achieved, comparable to the best observed in $Cu_2S$/CdS cells of the same design. The improved performance for $Cu_2S$-based devices is as a consequence of the higher open-circuit voltage achieved with the addition of zinc.

21797 **Laser-induced photoelectrochemistry. Time-resolved coulostatic-flash studies of cadmium sulfide electrodes.** Richardson, J.H.; Perone, S.P.; Deutscher, S.B. (Univ. of California, Livermore). Contract AC02-77ER04263. *Journal of Physical Chemistry, The ;* **85**: No. 4, 341-350(19 Feb 1981).

Coulostatic-flash irradiation of semiconductor-liquid-junction cells with a pulsed laser source permits time-resolved measurements of photopotential transients in the nanosecond time domain. The transients observed with CdS electrodes are unusual in that they exhibit wavelength and solution dependence. Both fast (10 ns) and slow ($\sim$ 100 ns) transients are observed in various aqueous electrolytes with irradiation near the band gap. Similar results in nonaqueous solution and with CdSe suggest that these transient photopotentials are related to processes within the semiconductor itself. A much slower ($\sim$ 1 $\mu$s) transient is observed in polysulfide solution with irradiation in the ultraviolet; it is suggested that this transient photopotential is due to light absorption by polysulfide.

21798 **Principles of photoelectrochemical, solar energy conversion.** Butler, M.A.; Ginley, D.S. (US DOE, Albuquerque, NM). *Journal of Materials Science ;* **15**: No. 1, 1-19(Jan 1980).

Photoelectrochemical devices for conversion of solar energy into both electrical energy and chemical energy are discussed with emphasis on how the various material properties of the photoactive electrodes influence device efficiency and stability. The similarity between photoelectrochemical cells (PECs) and solid state devices is used to model their behavior and optimize such parameters as band gap, doping level, minority carrier lifetime, etc. A model is presented which calculates the electron affinity of any semiconductor and allows the prediction of the open circuit voltage of wet photovoltaic cells and optimum biasing for chemical producing cells. The effects of absorbed ions at the semiconductor/electrolyte interface are reviewed. The temperature dependence of the energy levels in the semiconductor and the electrolyte are considered and the implications of these results to operation of PECs at elevated temperature are discussed. The major differences between PECs and solid state devices are the stability considerations. The thermodynamics of this problem is discussed. Other important degradation mechanisms and some solutions to these problems are reviewed. 66 refs.

21799 **Overview of the National Photovoltaics Program.** Fortenberry, J.W.; Hesse, J.L. (Jet Propulsion Lab., Pasadena, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1087-1091(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The National Photovoltaics Program, under mandate of the Photovoltaics RD and D Act of 1978, seeks to reduce system costs to a competitive level in both distributed and centralized grid-connected applications. Equally important, the program will also resolve the technical, institutional, legal, social, and environmental issues necessary to permit widespread use of photovoltaic energy systems. A key element in this program is the expectation that residential photovoltaic systems will become viable in the Southwestern United States in the mid-1980s when modules are priced at $0.70/peak watt and total installed system prices reach from $1.60 to $2.20/peak watt (in 1980 dollars).

21800 **Overview of photovoltaic collector technology status and objectives.** Costogue, E.N.; Ferber, R.R.; Thornhill, J.W. (Jet Propulsion Lab., Pasadena, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1092-1096(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The National Photovoltaics Program of the United States Department of Energy has the objective of bringing photovoltaic power systems to a point where they can supply a significant portion of the United States energy requirements by the year 2000. An overview is presented of the technology development objectives, accomplishments, and current status of flat-plate and concentrator collectors in achieving the National Photovoltaic Program goals. These goals are directed towards prducing low-cost, long-life collectors at a rate greater than 500 MW/year by 1986 at factory prices of less than $2800 per peak kilowatt by 1982 and $700 per peak kilowatt by 1986. The collector performance goals include efficiencies greater than 10%, and an expected operating lifetime in excess of twenty years.

21801 **Non-lattice-matched monolithic multicolor solar cell.** Zehr, S.W. (Rockwell International, Thousand Oaks, CA); Yang, H.T.; Miller, D.L.; Harris, J.S. Jr.; Yang, J.J.J.; Colemen, J.J.; Schaffer, W.J.; Stocker, P.J. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 986-990(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The promise of multicolor (multiple bandgap) solar cells for achieving conversion efficiencies in excess of 30% has been widely discussed. Current results of an effort to reach this performance goal with a multicolor cell consisting of a two-junction monolithic stack containing an intercell ohmic contact formed from a lattice mismatched heterojunction structure are discussed. The total device is fabricated by first separately growing the individual subcell structures by LPE or MOCVD and then joining them by a melt-regrowth process which simultaneously bonds the two converter structures and forms the required transparent ohmic contact between the wide and narrow bandgap conversion junctions. Individual junction design optimization calculations and preliminary performance results are discussed. Early results of fabrication and characterization of the bonded ohmic contact are also discussed.

21802 **Efficient use of the slar spectrum through the multiple junction cascade solar cell.** Bedair, S.M. (Research Triangle Inst., Research Triangle Park, NC); Phatak, S.B.; Andrews, J.E.; Timmons, M.L.; Lamorte, M.F.; Simons, M.; Hauser, J.R.; Chiang, J. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 991-995(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Multiple junction solar cells offer the potential of achieving significantly higher efficiency values than single junction cells. Theoretical calculations for a two junction cell give AMO, 1 sun efficiencies of 30 or more at 300 K. The general requirements for a two junction monolithic cascade cell are reviewed, and recent progress made in the experimental development of such a cell is described.

21803 **Performance improvement of silicon sheet solar cells by process optimization.** Yoo, H.; Ho, F. (Applied Solar Energy Corp., City of Industry, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 996-999(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The results and procedures to improve the performance of solar cells fabricated from various silicon sheet forms are described. The performance parameters included photovoltaic characteristics, such as open circuit voltage (Voc), short circuit current density (Jsc), curve fill factor (CFF) energy conversion efficiency (eta), and minority carrier diffusion length (L). Minority carrier diffusion

length was shown to be the ultimate limiting factor for the solar cell performance. Some sheet cells showed secondary losses resulting from lower Voc and CFF, caused by shunting of the junction. Efforts to improve solar cell performance by process modification resulted in significant cell efficiency increase for some sheet silicon.

21804 **Simplified method for predicting photovoltaic array output.** Evans, D.L. (Arizona State Univ., Tempe). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1047-1051(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

A simplified procedure for predicting the long term monthly average electrical output of photovoltaic arrays is presented. It is restricted to passively cooled max-power tracked arrays, but is applicable to both south facing fixed flat arrays and 2-D tracked concentrators. The procedure combines basic parameters characterizing the array with the local monthly mean temperature and the monthly K/sub T/ to yield a monthly average array efficiency which, when multiplied by the monthly array insolation gives the electrical energy output.

21805 **Hydrocarbons from plants: analytical methods and observations.** Calvin, M. (Univ. of California, Berkeley). *Naturwissenschaften ;* **67**: 525-533(1980).

From AAAS meeting; San Francisco, CA, USA (Jan 1980).

We have suggested that certain plants rich in hydrocarbon-like materials might be cultivated for renewable photosynthetic products. Two species were selected for experimental plantations: Euphorbia lathyris, an annual from seed and Euphorbia tirucalli, a perennial from cuttings. The yield from each species is over 10 barrels of oil/acre/year without genetic or agronomic improvement. In addition to plants, there are trees, such as species of Copaifera in Brazil and other tropical areas, which produce a diesel-like oil upon tapping. Each tree produces approximately 40 liters of hydrocarbon per year, and this material can be used directly by a diesel-powered car. Further efforts to develop plants as alternate energy sources are underway, as well as a continuing search for aditional plant species throughout the world which have a similar capability.

21806 **Technological and economic development of photovoltaics.** Costello, D.; Rappaport, P. *Annual Review of Energy ;* **5**: 335-356(1980).

Solar energy technologies, and photovoltaic technologies in particular, represent one of the more socially attractive of the technical solutions to the energy dilemma. This paper reviews the present status of photovoltaic technologies and investigates their potential role as an energy supply. The first key element is the physical characteristics of the technology. The second is the photovoltaic industry which translates technological advances into commercial products. The markets and their behavior in response to these products constitute the next critical element. Finally, US and foreign governments will continue to be involved in photovoltaics and will influence their development. Neither the technology, the industry, the markets, nor the public sector alone will dictate the development of photovoltaics. Rather, it will be the dynamic interaction of all these elements that determines the energy contribution of this technology. The four major sections of the paper deal with each of the key elements individually. The final section explores their interactions. 52 references.

21807 **Design and fabrication of high efficiency thin film CdS/Cu/sub 2/S solar cells.** Hall, R.B.; Meakin, J.D. (Univ of Del, Newark). *Thin Solid Films ;* **63**: No. 1, 203-211(Apr 1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

Thin film photovoltaic cells of CdS/Cu/sub 2/S which exhibit conversion efficiencies in excess of 9% have been designed and fabricated. Specific cell designs are prepared from an analysis of optical and electronic loss mechanisms operative in the cell. Material and engineering modifications to the fabrication process are then made to minimize specific energy conversion losses. The present cell design consists of five thin film layers which are sequentially prepared on a copper substrate 35 /mu/m thick. It is anticipated that practical conversion efficiencies of 14-15% can be achieved utilizing a (CdZn)S/Cu/sub 2/S junction designed to produce the maximum open-circuit voltage possible using Cu/sub 2/S as the absorbing layer. Present cell results which incorporate this design are presented. 18 refs.

21808 **Monolayer films of surfactant derivatives of methylene blue.** Valenty, S.J. (General Electric Co., Schenectady, NY). Contract EG-77-C-02-4395. *Journal of Colloid and Interface Science (Formerly Journal of Colloid Science) ;* **68**: No. 3, 486-491(1 Mar 1979).

Surfactant derivatives of methylene blue have been synthesized and shown to form stable monolayer films at the air-water interface. From a comparison of experimental II-A curves and dimensions derived from molecular models, probable orientations of the methylene blue chromophore in these films are discussed. The absorption spectra of glass-supported monolayer arrays of surfactant methylene blue derivatives are reported and show differences based on the number of hydrocarbon chains attached to the chromophore, the glass pretreatment, subphase, counterion, and surface pressure at which the film was transferred onto the glass surface. The abosrption spectra of methylene blue absorbed onto glass surfaces from aqueous solution are described and shown to depend on glass pretreatment.

21809 **Energy storage in organic photoisomers.** Jones, G. II; Chiang, S.H.; Xuan, P.T. (Boston Univ., MA). *Journal of Photochemistry ;* **10**: 1-18(1979).

Criteria for the successful photochemical storage of solar energy as latent heat in organic materials are outlined. Photoisomerization reactions which have some potential for storage of photon energy in kinetically stable products are surveyed. Emphasis is placed on well-known internal cycloadditions which display thermal reversibility, large storage capacities and high chemical and quantum efficiencies. Chemicals available on an industrial scale, which are known to undergo valence isomerization, is identified. Attempts to drive these reactions via exciplexes (complexes involving strong electron donor or electron acceptor sensitizers) are described. The sensitized isomerization of dimethylnorbornadiene-2,3-dicarboxylate (7) and a model compound, hexamethyldewarbenzene, are identified as bona fide exciplex isomerizations. Triplet sensitizers have been employed in the sensitization of 7 to visible light (to 500 nm). The potential importance of endothermic energy transfer in triplet sensitization (the upconversion of very low energy triplets) is discussed. The review includes developments by several research groups in the spectral sensitization of isomerizable substrates, the use of heterogeneous photosensitizers, and photocalorimetric techniques.

21810 **Electronic structural properties and photosynthesis.** Christoffersen, R.E. (Univ. of Kansas, Lawrence). *International Journal of Quantum Chemistry ;* **16**: 573-604(1979).

A review of recent theoretical studies of molecules of interest to photosynthesis is given, in which the results of ab initio self-consistent-field plus configuration-interaction studies are discussed. Ground-state and low-lying excited singlet and triplet state descriptions are presented for six molecules, including Mg-porphine Mg-chlorin, ethyl chlorophyllide a, and their corresponding magnesium-free analogs. The data are then used to rationalize a variety of observed properties, including molecular orbital structure, ionization potentials, chemical reactivity, Franck-Condon transition energies, oscillator strengths, transition polarizations, and other properties. As a result, relatively comprehensive and complete descriptions of the electronic structural features of chlorophyll a and related molecules are obtained, which are in general good agreement with available experimental data, but which also provide new concepts and reinterpretation of existing data in several instances. 66 references, 21 figures, 1 table.

## 1406 Photovoltaic Power Systems

*REFER ALSO TO CITATION(S) 21753. 21795. 21799. 21804. 21837. 22095.*

*22219*

**21811 (DOE/ER—0099) Assessment of a satellite power system and six alternative technologies.** Wolsko, T.; Whitfield, R.; Samsa, M.; Habegger, L.S.; Levine, E.; Tanzman, E. (Argonne National Lab., IL (USA)). Apr 1981. Contract W-31-109-ENG-38. 232p. NTIS, PC A11/MF A01.

The satellite power system is assessed in comparison to six alternative technologies. The alternatives are: central-station terrestrial photovoltaic systems, conventional coal-fired power plants, coal-gasification/combined-cycle power plants, light water reactor power plants, liquid-metal fast-breeder reactors, and fusion. The comparison is made regarding issues of cost and performance, health and safety, environmental effects, resources, socio-economic factors, and insitutional issues. The criteria for selecting the issues and the alternative technologies are given, and the methodology of the comparison is discussed. Brief descriptions of each of the technologies considered are included. (LEW)

**21812 (DOE/ER/10160—T4) Examination of some hypothetical SPS rectenna sites within the contiguous United States of America. Part I. Precipitation effects on hypothetical SPS sites in the USA. Part II. Point-to-point microwave and service mode communications systems near four hypothetical SPS rectenna sites in the continental United States.** Dutton, E.J.; Warner, B.D. (Department of Commerce, Boulder, CO (USA). Inst. for Telecommunication Sciences). May 1981. Contract AI01-80ER10160. 38p. NTIS, PC A03/MF A01.

The report of Grant et al., (1980) describes the EMC (electromagnetic compatibility) problems for the candidate SPS rectenna site in the Mojave Desert of California. This study examines the precipitation effects at nine other hypothetical SPS rectenna sites and the licensed transmitter density at four proposed SPS rectenna sites. The results of the precipitation study indicate that the transmission loss will not vary by more than 3% from site-to-site for the nine sites considered. Results of the licensed transmitter study for four sites support the contention that a strong correlation exists between population density and operational communications systems within small area (150 Km x 150 Km).

**21813 (DOE/ET/20279—118) Operational experiences in lead-acid batteries for photovoltaic systems.** Brench, B.L. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1981. Contract AC02-76ET20279. 6p. (CONF-810526—18). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

MIT Lincoln Laboratory has designed photovoltaic systems which use different kinds of lead-acid batteries, including units normally used for starting, lighting, and ignition (SLI) and for motive power. The experiences gained from four of these battery subsystems during field operation, particularly battery type versus system load, versus performance characteristics, and versus expected lifetime, are compared and analyzed.

**21814 (DOE/ET/20279—123) Residential photovoltaic system designs.** Russell, M.C. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1981. Contract AC02-76ET20279. 5p. (CONF-810526—17). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

A project to develop Residential Photovoltaic Systems has begun at Massachusetts Institute of Technology Lincoln Laboratory with the construction and testing of five Prototype Systems. All of these systems utilize a roof-mounted photovoltaic array and allow excess solar-generated electric energy to be fed back to the local utility grid, eliminating the need for on-site storage. Residential photovoltaic system design issues are discussed and specific features of the five Prototype Systems now under test are presented.

**21815 (DOE/ET/20279—128) Loss of line shutdown for line-commutated utility-interactive inverter.** Landsman, E.E. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Mar 1981. Contract AC02-76ET20279. 10p. NTIS, PC A02/MF A01.

The line-commutated, single-phase, utility-interactive inverter has been used in utility-connected photovoltaic (PV) and wind energy systems because it is commercially available at an attractive price. If unity power factor operation is required, a shunt capacitor can be used. This causes a problem if the utility line is disconnected; the inverter can continue to run and can thus be a hazard. This can be solved by using a fast-acting overvoltage detection circuit which operates directly on the inverter control electronics.

**21816 (DOE/ET/20279—132) Residential photovoltaic power systems for the northeast.** Russell, M.C. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1981. Contract AC02-76ET20279. 5p. (CONF-810526—24). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

A project to develop Residential Photovoltaic Systems has begun at Massachusetts Institute of Technology Lincoln Laboratory with the construction and testing of five Prototype Systems. Each of these systems utilizes a roof-mounted photovoltaic array and allows excess solar-generated electric energy to be fed back to the local utility grid, eliminating the need for on-site storage. Specific features of the five Prototype Systems now under test are presented, and performance results to date are discussed.

**21817 (DOE/ET/20279—133) Carlisle house: an all-solar electric residence.** Nichols, B.E.; Strong, S.J. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.; Solar Design Associates, Lincoln, MA (USA)). 1981. Contract AC02-76ET20279. 4p. (CONF-810526—16). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

An all-solar electric house that derives most of its energy requirements from the sun has been built in Carlisle, Massachusetts. A solar photovoltaic array on the roof produces electricity; passive solar features provide much of the space heating; thermal collectors provide domestic hot water; and energy conservation measures reduce electrical and thermal energy requirements to a minimum. The solar photovoltaic array produces dc current that is transformed to ac power in a utility-interactive inverter connected to the utility service. There is no on-site electric storage. The array is sized so that, on a net basis, most of the annual energy for the house comes directly from the sun. Initial performance data are presented. State-of-the-art energy conservation and passive solar heating techniques were employed using direct passive solar gain, sun-controlling geometry, fully insulated, staggered-stud-wall construction, and internal thermal mass to create a house design with low heating and cooling loads. Window area was reduced on the north, east, and west elevations and these units were triple glazed.

**21818 (DOE/ET/20279—135) Operating experience with the natural bridges national monument photovoltaic power system.** Solman, F.J.; Grossman, B.L. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1981. Contract AC02-76ET20279. 6p. (CONF-810526—15). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

The 100-kW photovoltaic power system at Natural Bridges National Monument in southwestern Utah has been in operation since May 1980. A comparison of system simulation with actual operation has been performed, good agreement has been found, and results are presented. In addition, conservation measures and their benefits are described. Operating experience with the system is presented, including measured component performance of the arrays, batteries, inverters, and system overhead loads.

**21819 (DOE/ET/20279—138) Effect of electrical-utility-system voltage harmonics on induction motors.** Rasmussen, N.E. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Mar 1981. Contract AC02-76ET20279. 6p. NTIS, PC A02/MF A01.

Distortion of the electrical utility system voltage waveform can result in damage to or malfunction of user electrical equipment. An experiment was carried out to determine the effect of utility

voltage harmonics on the temperature rise of single-phase induction motors. The results suggest that utility voltage harmonics do not significantly affect the operating temperature of a single-phase induction motor until the amplitudes of the harmonics are much larger than the amplitudes currently present in the US utility system.

21820 **(DOE/ET/20356—2) Photovoltaics Program: utility interface southwest regional workshop proceedings.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1 Apr 1981. Contract AI01-76ET20356. 53p. (CONF-8009150—). NTIS, PC A04/MF A01.

From Photovoltaics program utility interface southwest regional workshop; Pasadena, CA, USA (9 Sep 1980).

This was the first of a series of regional workshops that will focus on the photovoltaic and utility interface, and the use of photovoltaics as a cogeneration option by utilities. The needs and constraints of the utilities are defined and an understanding is established of the capabilities and limitations of photovoltaic systems as an alternative electricity generation option by utilities. Utilities' viewpoints regarding large-scale central systems and small-scale, interconnected, distributed systems are given. The Public Utility Regulatory Policies Act and other economic, legislative, and regulatory factors affecting photovoltaic systems are discussed. Current status of photovoltaic systems with respect to the Department of Energy Photovoltaic Program is given. (LEW)

21821 **(DOE/IR/05106—T24) Local government guide to the emerging technologies of cogeneration and photovoltaics. Energy technology report of the energy task force of the urban consortium.** (Public Technology, Inc., Washington, DC (USA); Planning and Management Associates of Greater Washington, Inc., DC (USA)). 1980. Contract FG02-78IR05106. 44p. NTIS, PC A03/MF A01.

An overview of cogeneration and photovoltaics systems is presented to provide local government managers a basic understanding of the technologies. Issues and considerations associated with applications are presented. Discussions cover installation and maintenance requirements, equipment availability, costs, and risks/benefits. Data describing demonstration sites and contacts for further information are provided. (MCW)

21822 **(DOE/NASA/20485—8) Review of stand-alone photovoltaic application projects sponsored by US DOE and US AID.** Bifano, W.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1981. Contract AI01-76ET20485. 12p. (NASA-TM—81738; CONF-810509—32). NTIS, PC A02/MF A01.

From Annual conference of the International Solar Energy Society; Philadelphia, PA, USA (26 May 1981).

The results of photovoltaic application projects conducted to date by Lewis Research Center for both DOE and AID are reviewed and similar projects slated for implementation in the near future are described. The economic viability of photovoltaic systems relative to alternative systems for remote applications is also addressed. (MHR)

21823 **(SAND—81-0897) On-site data acquisition system for photovoltaic applications experiments.** Evans, T.L. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 53p. NTIS, PC A04/MF A01.

A data acquisition system for obtaining performance and meteorological data at photovoltaic applications experiments sites located throughout the United States has been developed. This system is fully automated, and the acquired data is transmitted periodically to a remote Data Reduction Center for analysis and reporting. The data acquisition system can also be used for on-site data presentations to facilitate photovoltaic system start-up and prove-in.

21824 **(SAND—81-1193C) Array subsystem development for photovoltaic-array fields.** Post, H.N.; Schueler, D.G. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 7p. (CONF-810526—20). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

The definition and development of low-cost array field subsystems for intermediate and central power station applications are described. The array subsystem portion of a photovoltaic power system represents the major cost item in a system and typically includes the photovoltaic modules, array foundations and structures, field wiring, array installation, and system electrical protection. Array cost-efficiency tradeoffs are examined and evaluated in terms of allowable subsystem costs. In addition, cost data and installation experience for a typical intermediate-size flat panel (ground mounted) application experiment are examined with a focus on cost reduction activities. Subsystem requirements and design considerations are discussed and specific results and guidelines for low-cost array field design are presented.

21825 **DOE perspective on photovoltaics development.** Prince, M.B.; Maycock, P.D.; Magid, L.M. (Dept. of Energy, Washington, DC). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1000-1006(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The United States Department of Energy (DOE) last year issued a draft Multi-Year Program Plan, dated June 6, 1979, for the Division of Photovoltaic Energy Systems. The Program's objective, as outlined in the Plan and presented is to bring photovoltaic systems, via substantial research, development and demonstrations aimed at achieving major cost reductions and market penetration, to the point where they are able to supply a significant portion of the United States' energy requirements. A key element in this program is the expectation that photovoltaic residences will begin to be cost-effective within the Southwestern United States when modules are priced at $0.70/peak Watt and the total installed systems will cost from $1.60 to $2.20/peak Watt (in 1980 dollars). The current program anticipates this occurring in 1986.

21826 **Hybrid photovoltaic/thermal systems with a solar-assisted heat pump.** Kush, E.A. (Brookhaven National Lab., Upton, NY). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1021-1025(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The methods by which PV/T solar can be combined with a heat pump are discussed with particular emphasis on the potential intrinsic to the series or SAHP PV/T system - with ground coupling possibilities included. Applicable work in the heat pump and collector areas is described and direction for future effort is suggested.

21827 **Flat plate combined photovoltaic/thermal energy system.** Strong, S.J. (Solar Design Associates, Canton, MA); Kreisman, W.S. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1052-1054(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The work described began with the author's interest in developing a combined photovoltaic/thermal (P.V./T.) system for residential applications where aesthetics and efficiency were prime considerations. Sponsored in part by a research and development grant from the US Department of Energy and MIT Lincoln Laboratory, the design work investigated air and liquid as heat transfer media, cell configuration and efficiencies, cell bonding and encapsulation, glazing systems and architectural integration. A prototype high density, high efficiency liquid cooled P.V./T. module was constructed and is currently being tested. Plans are now underway for the construction of a residence using this system. The design tradeoffs associated with P.V./T. systems are discussed, describing the design development and fabrication methods.

21828 **Simplified design methods for photovoltaic systems.** Siegel, M.D.; Beckman, W.A. (Univ. of Wisconsin, Madison). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1055-1059(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

A method is presented that uses monthly average weather data and easily determined array parameters for estimating the monthly average conventional energy displacement from photovol-

taic systems. The system load is assumed to be constant throughout any portion of the day that includes the daylight hours. Energy produced in excess of the load is assumed to be dumped or fed back into a utility. If a battery is included in the system, part of the excess energy can be stored for later use. The design method annual predicted system performance compares to within a standard deviation of 3% of that predicted by hour-by-hour calculations using TRNSYS for all system configurations examined.

**21829 Photovoltaic concentrator development.** Shafer, B.D.; Boes, E.C. (Sandia Labs., Albuquerque, NM). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1060-1066(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Photovoltaic (PV) concentrator arrays replace most of the expensive solar cell area in the array with low cost optical concentrators. This approach benefits from the fact that cell efficiencies can be higher in concentrated sunlight. In addition, useful thermal energy can be generated if it is desirable to do so. A number of PV concentrator array designs have been fabricated to date. The most promising candidates are point and linear focus Fresnel lens designs, and linear focus parabolic trough designs. A review of the status of present generation arrays is given as well as some insight into what are the more promising component and module developments.

**21830 Reference conditions for reporting terrestrial photovoltaic performance.** Ross, R.G.;Gonzalez, C.C. (Jet Propulsion Lab., Pasadena, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1091-1097(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The subject of performance reference conditions for terrestrial photovoltaic array measurememts is developed in a manner which provides quantitative selection criteria for the choice of reference solar spectrum, irradiance level and solar cell temperature. In addition to providing a repeatable reference for performance comparisons, it is shown that the choice of reference conditions directly controls the accuracy of array energy output prediction calculations. The accuracy of energy output calculations based on commonly used reference conditions is examined for a variety of array types and site locations in the US using tapes of hourly solar irradiance and temperature measurements in conjunction with solar spectrum models. Conclusions are drawn relative to the accuracy associated with present reference conditions, and recommendations are made concerning alternative reference conditions with improved accuracy.

**21831 Performance criteria and test standards for photovoltaic arrays.** Ross, R. (Jet Propulsion Lab., Pasadena, CA); Hoffman, A.; Gasner, S.; DeBlasio, R. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1098-1103(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The purpose, rationale, and approach associated with the development of performance criteria and test methods for photovoltaic arrays are described as part of the Department of Energy's National Photovoltaic Program. These development efforts represent a new approach by the Federal government to encourage and facilitate the development of technology in an infant industry. Included is a description of the forthcoming document, Interim Performance Criteria for Photovoltaic Energy Systems, and some examples of definitions, criteria, and test methods that are contained in that document.

**21832 Progress in the performance of terrestrial solar cell modules.** Runkle, L.D.; Dumas, L.N. (Jet Propulsion Lab., Pasadena, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1109-1113(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Since the start of the Low Cost Solar Array (LSA) Project in 1975, approximately 400 KW of photovoltaic solar cell modules have been purchased in four separate blocks. These modules, representative of designs and manufacturing technology in the period from 1976 to the present, have been subjected to laboratory and field tests and subsequent evaluation. A review of certain figures-of-merit for the modules is useful in assessing the progress of the project in meeting a price goal of 70 cents/watt in 1980 dollars and at standard test conditions. Analysis of the results of the testing program provides an assessment of the functional performance and durability of the modules and also an evaluation of the utility of the tests used in qualifying and characterizing the modules. The experience of the LSA Project in procuring, testing and evaluating these modules is given.

**21833 Wind loads on photovoltaic arrays.** Weaver, R.W. (Jet Propulsion Lab., Pasadena, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1114-1117(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

As a part of the Jet Propulsion Laboratory's Low-Cost Solar Array Project, studies were conducted to determine the mechanical loads on flat-plate arrays due to natural winds. The objective of the studies was to determine analytically the expected wind loads on the arrays for different array attitudes, configurations and wind directions. These loads are important in the overall system design because of the resultant structural design associated with the loads. Other areas of the Low-Cost Solar Array Project will use these data to determine system and life-cycle costs.

**21834 Application potentials for flat plate and concentrator photovoltaic collectors.** Ferber, R.R.; Costogue, E.N.; Thornhill, J.W. (Jet Propulsion Lab., Pasadena, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1136-1140(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Photovoltaic (PV) systems are expected to become low-cost sources of electrical energy, capable of competing in future markets. These PV systems utilize solar cell arrays for converting solar energy directly into electrical energy. The two major PV system concepts under intensive development today are: (a) flat plate solar collectors, which have a power capacity of 80 to 120 watts/$m^2$, and (b) concentrator enhanced solar collectors, with possible capacities of 150 watts/$m^2$, depending on the specific concentration ratio, the efficiency of the optical system, and the conversion efficiency of the solar cells. The emerging performance characteristics of these systems, when used for remote stand alone, residential (below 10 kW), intermediate (10 kW to 10 MW), and central power station applications, suggest that either technology will provide satisfactory performance in many cases. Economic studies, taking into account the many trade-offs, indicate that both will compare favorably with other energy sources after 1986. The performance characteristics of these two photovoltaic technologies are examined, the merits and limitations of each are discussed, and definition of areas where they will be competitive for ultimate commercial use are attempted.

**21835 Effects of government policies on the economic viability of photovoltaic systems.** Kasper, J.V.V. (Vincent Rae Associates, Los Angeles, CA); Davis, R.B. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1225(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

**21836 Performance measurement reference conditions for terrestrial photovoltaics.** Gonzalez, C.C.; Ross, R.G. (Jet Propulsion Lab., Pasadena, CA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1401-1405(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

One important aspect of measuring terrestrial photovoltaic array electrical performance is the choice of a reference solar spectrum. Sensitivity to this choice is caused by the narrow spectral response of photovoltaic materials and the associated dependency of certain annual energy output calculational procedures. The accuracy of energy output calculations based on commonly used reference spectra is examined for a variety of array types and site locations in the US using tapes of hourly solar irradiance and temperature measurements in conjunction with solar spectrum models. Conclusions are drawn relative to the accuracy associated with the commonly used air mass 1.5 reference spectrum, and alternative reference spectra with improved accuracy are illustrated.

## 1407 Solar Thermal Power Systems

*REFER ALSO TO CITATION(S) 22219*

**21837 (DOE/ET/20375—T1) Northeast regional assessment study for solar electric options in the period 1980-2000.** (JBF Scientific Corp., Wilmington, MA (USA)). Apr 1981. Contract AC06-77ET20375. 330p. NTIS, PC A15/MF A01.

Opportunities for demonstration and large scale deployment of solar electric facilities are identified and assessed. Technical, economic, and institutional factors that can contribute to an accelerated use of solar energy for electric power generation are defined. The following topics are covered: a description of the Northeast Region and its solar resources, central station applications, a dispersed user analysis, user viewpoints and institutional factors, and market potential for dispersed solar electric systems. (MHR)

**21838 (DOE/SF/10756—1) Preliminary heat pipe testing program. Final technical report.** (Bechtel National, Inc., San Francisco, CA (USA)). Mar 1981. Contract AC03-79SF10756. 282p. NTIS, PC A13/MF A01.

The combined cycle solar power system studies are described. The heat pipe receiver analysis and its results are presented. The test plans and designs of the test stands and test articles are described. The test results and evaluation of these results are presented. (MHR)

**21839 (SAND—81-0113) Power-cable-carrier control ($PC^3$) system.** Alvis, R.L.; Wally, K.; Rosborough, J.R. . (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 50p. NTIS, PC A03/MF A01.

A control system has been developed that uses a carrier signal imposed on an existing ac power circuit to transmit commands. This system was specifically developed to control an entire solar collector field by sending sun-tracking information to the trough collectors or by commanding them to assume safe positions (STOW) if out-of-limit conditions were encountered. Objectives were to develop a control system that operates reliably and has enough functions to control an entire collector field, yet do it at less cost than for conventional approaches. Development, design, operating characteristics, and field testing and results of the new system, the Power Cable Carrier Control ($PC^3$) System are described.

**21840 Total energy systems design.** Harrigan, R.W. (Sandia Labs., Albuquerque, NM). pp 161-204 of Solar energy technology handbook. Part B. Applications, systems design, and economics. Dickinson, W.C.; Cheremisinoff, P.N. (eds.). New York, NY; Marcel Dekker, Inc. (1980).

The development of solar total energy (STE) system designs to the degree useful in evaluating concept feasibility is discussed. Most potential users initially have only a general idea of their energy requirements, and the objective here is to provide a basis for formulating designs using this information. In addition, since in a developing technology such as solar, costs are very ill defined, a design strategy stressing maximized utilization of solar equipment is employed without detailed economic evaluation. The philosophy is that any solar equipment used to its maximum extent will be the most cost effective. Some rough guidelines on solar equiment costs are outlined. It is attempted to help the user to determine if there is enough potential gain to warrant investing the time and money required to execute a detailed design of a STE facility for the particular application. After a brief review of the history of total energy and an introduction of the concept of solar total energy, a hypothetical application is defined to serve as an example to illustrate the various design considerations to be discussed. STE design, load compatibility, sizing, performance, and economics are discussed. (WHK)

## 1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

**21841 (DOE/CH/00135—3) Test results of heat-exchanger cleaning in support of ocean thermal energy conversion.** Lott, D.F. (Naval Coastal Systems Center, Panama City, FL (USA)). Dec 1980. Contract AI02-79CH00135. 283p. (NCSC-TM—298-80). NTIS, PC A13/MF A01.

These tests evaluated flow-driven brushes, recirculating sponge rubber balls, chlorination, and mechanical system/chlorination combinations for in-situ cleaning of two potential heat exchanger materials: titanium and aluminum alloy 5052. Tests were successful when fouling resistance was $<3.0 \times 10^{-4}$ ft$^2$ hr-$^0$F/Btu. Results indicated systems and cleaning techniques using brushes, soft sponge balls, and various concentrations of chlorine had some potential for maintaining heat transfer efficiency.

**21842 (DOE/ET/21002—T14) OTEC support services. Quarterly technical progress report No. 12, 15 February-14 May 1981.** (VSE Corp., Alexandria, VA (USA)). May 1981. Contract AC02-78ET21002. 14p. NTIS, PC A02/MF A01.

The background, objectives, and technical progress for the OTEC program are reviewed briefly. (MHB)

**21843 (SERI/TR—634-1011) Ocean energy conversion systems annual research report.** (Solar Energy Research Inst., Golden, CO (USA)). Mar 1981. Contract AC02-77CH00178. 192p. NTIS, PC A09/MF A01.

Alternative power cycle concepts to the closed-cycle Rankine are evaluated and those that show potential for delivering power in a cost-effective and environmentally acceptable fashion are explored. Concepts are classified according to the ocean energy resource: thermal, waves, currents, and salinity gradient. Research projects have been funded and reported in each of these areas. The lift of seawater entrained in a vertical steam flow can provide potential energy for a conventional hydraulic turbine conversion system. Quantification of the process and assessment of potential costs must be completed to support concept evaluation. Exploratory development is being completed in thermoelectricity and 2-phase nozzles for other thermal concepts. Wave energy concepts are being evaluated by analysis and model testing with present emphasis on pneumatic turbines and wave focussing. Likewise, several conversion approaches to ocean current energy are being evaluated. The use of salinity resources requires further research in membranes or the development of membraneless processes. Using the thermal resource in a Claude cycle process as a power converter is promising, and a program of R and D and subsystem development has been initiated to provide confirmation of the preliminary conclusion.

**21844 Electric power generation: ocean thermal energy conversion.** Cohen, R. (Dept. of Energy, Washington, DC). pp 379-438 of Solar energy technology handbook. Part B. Applications, systems design, and economics. Dickinson, W.C.; Cheremisinoff, P.N. (eds.). New York, NY; Marcel Dekker, Inc. (1980).

A description of the background, status, and future prospects of OEC technology is presented. topics include ocean siting, thermal resource, and environmental assessment; power systems; ocean systems; system costs; engineering development; and market potential. 83 references. (WHK)

## 1409 Solar Thermal Utilization

*REFER ALSO TO CITATION(S) 21611, 21722, 21748, 21748, 21749, 21749, 21754, 21817, 21817, 21826, 21942, 21946, 21951, 22043, 22205, 22217, 22218, 22219, 22219, 22221*

**21845 Parametric evaluation of the double envelope building design using a detailed numerical thermal simulation model.** Ortega, J.K.E.; Connolly, J.M. (Solar Energy Research Inst., Golden, CO). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.1**: 497(1980). (CONF-801016—(Vol.1)). Amherst, MA, USA (19 Oct 1980).

**21846 (DOE/CS/30169—6) Suncatcher monitoring project. Semi-annual technical report, July-December 1980.** Treleven, K.; Maeda, B.T. (Davis Alternative Technology Associates, CA (USA)). 27 Apr 1981. Contract FG02-79CS30169. 30p. NTIS, PC A03/MF A01.

Data collected during the second half of 1980 are presented for the Suncatcher - a passive solar heating system. Data include outdoor and indoor temperatures, auxiliary gas used, heating degree days, load and performance data, and storage temperatures in graphical and in tabular form. Work on the data acquisition system is briefly described. Some relevant computer codes are listed. (LEW)

**21847 (DOE/CS/30210—T1) Design and field testing of solar-assisted earth coils. Final report, August 1, 1978-January 31, 1981.** Bose, J.E. (Oklahoma State Univ., Stillwater (USA). School of Technology). 1981. Contract AS03-79CS30210. 106p. NTIS, PC A06/MF A01.

Two types of earth coils were designed, constructed, and are operational on the Oklahoma State University campus. A nominal 1000-foot, 4-inch, PVC coil buried in a serpentine pattern is the heat source/sink for two commercial heat pump systems. This system is vented which allows the easy placement of thermocouples down its length to measure changes in temperature as well as changes in overall U values as a function of length. Integral to the earth coil is a 1000-gallon uninsulated water storage tank in which solar energy from 210 $ft^2$ of solar collectors (single-glazed, metal absorber) can be added directly to the heat pump, circulated through the 1000-foot earth coil system, or added to an insulated storage tank for direct transfer. Temperature ranges for this type of system at the four-foot level are from a nominal range of 78°F in mid-September to a low of 42°F in mid-February in the absence of heat rejection or absorption. The second type of earth coil under study was a vertical coil approximately 240 feet in length. Placement of the coil is with a conventional water well drilling machine. The vertical heat exchanger consists of a 5-inch PVC pipe which is capped at both ends and pressurized at approximately 15 PSIG. This sealed and pressurized heat exchanger allows a low power pump to circulate water through both the heat pump and vertical heat exchanger system.

**21848 (DOE/CS/30224—T1) Second generation ground coupled solar assisted heat pump systems. Six month progress report.** Rhodes, G.W.; Backlund, J.C.; Helm, J.M. (FAFCO, Inc., Menlo Park, CA (USA)). Jan 1981. Contract AC03-80CS30224. 84p. NTIS, PC A05/MF A01.

Progress is reported on an investigation of the technical and commercial viability of a novel ground coupled, solar assisted heat pump system for residential space heating and cooling applications. Specific areas of study are solar collector/heat rejector performance, flat plate earth heat exchanger performance, system performance simulations, and commercialization and marketing analysis. Collector/rejector performance, determined by various thermal experiments, is discussed. The design and construction of an experimental site to study ground coupling is discussed. Theoretical analysis is also presented. The performance of the GCSAHP system and conventional alternatives, as determined by simple computer models, is presented and discussed. Finally, the commercial viability of this unique space conditioning system is examined.

**21849 (DOE/CS/30367—4) Wall collector design analysis: project status report No. 2. Hing/daylighting prototype development, Phase I.** Aronson, S.J.; deCampo, R.; Snyder, M.K. (Butler Mfg. Co., Kansas City, MO (USA); Princeton Energy Group, NJ (USA)). Mar 1981. Contract FC02-80CS30367. 60p. NTIS, PC A04/MF A01.

The design process and energy analyses for the wall (air) collector component for the passive/hybrid system building alternatives for pre-engineered metal buildings are described. A hybrid collector was coupled to the rockbed storage and ceiling plenum of the office and maintenance spaces. A thermosyphon collector was coupled directly to the interior space of the warehouse. The schematic design, design development, and performance analysis are included. (MHR)

**21850 (DOE/CS/30367—T1) Test building instrumentation cooperative agreement: heating/daylighting prototype development. Phase II. Passive and hybrid solar manufactured building project. Project status report No. 2, April 16, 1980-March 16, 1981.** Lindsey, L.L.; Snyder, M.K. (Butler Mfg. Co., Grandview, MO (USA). Research Center; Princeton Energy Group, NJ (USA)). 23 Mar 1981. Contract FC02-80CS30367. 8p. NTIS, PC A02/MF A01.

Progress is reported on the test building instrumentation and problems encountered are described. An instrumentation trip report is presented dealing with installation of data acquisition systems, roof and roll runner building. (MCW)

**21851 (DOE/CS/31587—T2) Proprties of the Carrol system and a machine design for solar-powered, air-cooled, absorption space cooling. Phase I and Phase II. Final report, September 1977-March 1979.** Biermann, W.J. (Carrier Corp., Syracuse, NY (USA). Energy Systems Div.). May 1981. Contract AC03-77CS31587. 124p. NTIS, PC A06/MF A01.

The name Carrol has been selected as a convenient shorthand designation for a prime candidate chemical system comprising ethylene glycol-lithium bromide as an absorbent mixture with water as a refrigerant. The instrumentation, methods of handling data and numerical results from a systematic determination of Carrol property data required to design an air cooled absorption machine based on this chemical system are described. These data include saturation temperature, relative enthalpy, density, specific heat capacity, thermal conductivity, viscosity and absorber film heat transfer coefficient as functions of solution temperature and Carrol concentration over applicable ranges. For each of the major components of the absorption chiller, i.e., generator, chiller, absorber, condenser, heat exchanger, purge and controls, the report contains an assembly drawing and the principal operating characteristics of that component.

**21852 (DOE/CS/32867—T1) Direct contact liquid-liquid heat exchanger for solar-heated and -cooled buildings. Final report, January 1, 1979-May 30, 1980.** Karaki, S.; Brothers, P. (Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.). Jun 1980. Contract AS02-76CS32867. 165p. NTIS, PC A08/MF A01.

The procedure used was to obtain experimental performance data from a solar system using a DCLLHE for both heating and cooling functions, develop a simulation model for the system, validate the model using the data, apply the model in five different climatic regions of the country for a complete year, and estimate the life-cycle cost of the system for each application. The results are compared to a conventional solar system, using a standard shell-and-tube heat exchanger.

**21853 (DOE/EIA/10189—T2) Diffusion of solar energy technologies in the new-construction market: a survey of new solar-home and onventional-home buyers.** Rains, D.; Dunipace, D.; Woo, C.K. (California Energy Commission, Sacramento (USA)). Feb 1981. Contract FG01-79EI10189. 64p. NTIS, PC A04/MF A01.

Comsumer motivations for choosing a solar energy equipped new home when the non-solar or conventional model was also available were investigated. The approach was to test the relative importance of demographic, dwelling unit, and heating system characteristics in household decisions to purchase a home equipped with solar energy devices. Two statistical models were developed: one to examine the relationship between the types of home buyers (as an identifiable market segment) and the decision to purchase a solar home, and the other to compare the energy use of solar vs. conventional homes selected in the sample. (MHR)

**21854 (DOE/NASA/CR—161724) Solar energy system economic evaluation. Final report for SEECO Lincoln, Lincoln, Nebraska.** (International Business Machines Corp., Huntsville, AL (USA). Federal Systems Div.). Sep 1980. Contract AI01-76CS31037. 95p. NTIS, PC A05/MF A01.

The economic analysis of the solar energy system that was installed at Lincoln, Nebraska is developed for this and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis is accomplished

based on the technical and economic models in the f-chart design procedure with inputs based on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system cost over a projected twenty year life: life cycle savings, year of positive savings and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. Although budget constraints preclude an economic reevaluation of each of the sites, a similar site, Carlsbad, New Nexico, was done. When 1985 escalated values for fuel, costs, mass production, and improved design and installation techniques were applied, a significantly higher degree of savings was realized.

21855 **(DOE/NASA/CR—161725) Solar Energy System Economic Evaluation final report for Colt Pueblo, Pueblo, Colorado.** (IBM Federal Systems Div., Huntsville, AL (USA)). Sep 1980. Contract AI01-76CS31037. 107p. NTIS, PC A06/MF A01.

The economic analysis of the solar energy system that was installed at Pueblo, Colorado is developed for this and five other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis is accomplished based on the technical and economic models in the f-chart design procedure with inputs based on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system cost over a projected twenty year life: life cycle savings, year of positive savings and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. Although budget constraints preclude an economic reevaluation of each of the sites, a similar site, Carlsbad, New Mexico, was done. When 1985 escalated values for fuel, costs, mass production, and improved design and installation techniques were applied, a significantly higher degree of savings was realized.

21856 **(DOE/NASA/CR—161726) Solar Energy System Economic Evaluation final report for IBM System 4, Clinton, Mississippi.** (IBM Federal Systems Div., Huntsville, AL (USA)). Sep 1980. Contract AI01-76CS31037. 101p. NTIS, PC A06/MF A01.

The economic analysis of the solar energy system that was installed at Clinton, Mississippi is developed for this and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis is accomplished based on the technical and economic models in the f-chart design procedure with inputs based on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system cost over a projected twenty year life: life cycle savings, year of positive savings and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. Although budget constraints preclude an economic reevaluation of each of the sites, a similar site, Carlsbad, New Mexico, was done. When 1985 escalated values for fuel, costs, mass production, and improved design and installation techniques were applied, a significantly higher degree of savings was realized.

21857 **(DOE/NASA/CR—161728) Solar energy system economic evaluation. Final report for IBM system 3, Glendo, Wyoming.** (IBM Federal Systems Div., Huntsville, AL (USA)). Sep 1980. Contract AI01-76CS31037. 102p. NTIS, PC A06/MF A01.

The economic analysis of the solar energy system that was installed at Glendo, Wyoming Operational Test Site (OTS) is developed for Glendo and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis is accomplished based on the technical and economic models in the f-chart design procedure with inputs based on the characteristics of the parameters of present worth of system cost over a projected twenty year life: life cycle savings, year of positive savings, and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. The assumptions used in the economic analyses of this report are not typical savings that could be realized in future installations of these types of solar heating and cooling systems. Although budget constraints preclude an economic reevaluation of each of the sites, Carlsbad, New Mexico, was done. When 1985 escalated values for fuel, costs, mass production, and improved design and installation techniques were applied, a significantly higher degree of savings was realized. Similar results could be expected for the site in this report.

21858 **(DOE/R5/10216—T1) Bridgeview Park facility solar retrofit.** (City Water, Light and Power, Springfield, IL (USA)). 1981. Contract FG02-80R510216. 83p. NTIS, PC A05/MF A01.

The weatherization and insulation of a presently unheated frame park building and the installation of a Trombe wall on the south side of the structure for passive solar heating are planned. The major objectives of the project are to increase the exposure of local residents and visitors to passive solar technology and to demonstrate the applicability of passive solar technology to residential, commercial and recreational buildings. Some changes in the original plans are discussed. Five blueprints illustrate the planned improvements. (LEW)

21859 **(DOE/SF/10549—T1) Solar-assisted heat pump field performance evaluation. Final report.** (E-Tech, Inc., Atlanta, GA (USA)). 28 Nov 1980. Contract AC03-79SF10549. 151p. NTIS, PC A08/MF A01.

An analysis carried out to determine some guidelines to use in laying out six ground coil installations is summarized. The installation of the solar-assisted ground coupled heat pumps is described. The instrumentation employed at each of the installations in order to obtain performance data is discussed. (MHR)

21860 **(DOE/SF/10606—T1) Solar repowering/industrial retrofit system for the Provident Energy Company Refinery. Topical report, September 28, 1979-July 15, 1980.** Raghavan, R. (Foster Wheeler Development Corp., Livingston, NJ (USA)). Mar 1980. Contract AC03-79SF10606. 146p. NTIS, PC A07/MF A01.

This report summarizes the program activities from the beginning of the project (October 1979) to February 15, 1980. The primary effort during the first portion of the period was the preparation of the System Requirements Specification. Following this effort, the system and subsystem trade-off studies and analyses were performed. The results of these studies produced the most practical conceptual design for the Provident Refinery central receiver solar energy plant.

21861 (LA—8797-PR, pp 3-19) **Passive Solar Systems.** Apr 1981. NTIS, PC A05/MF A01.

In Energy technology. Progress report, October-December 1980.

Progress is reported in the Passive Solar Systems program with the initiation of a study on the performance of so-called suntempered buildings, which represent minimal departures from conventional building design. Additional detailed analyses of the Balcomb house, including the thermal effects of water transpiration in the greenhouse, are reported. The convective loop experiment has shown that collector efficiency is nearly independent of the depth of the flow channels in the collector.

21862 **(LA-UR—81-1039) Performance summary of the Balcomb solar home.** Balcomb, J.D.; Hedstrom, J.C.; Perry, J.E. Jr. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810509—34). NTIS, PC A02/MF A01.

From Annual conference of the International Solar Energy Society; Philadelphia, PA, USA (26 May 1981).

The heating performance of the Balcomb passive solar home is re-evaluated based on detailed review of 85 channels of data taken during six weeks of 1980. This led to a re-analysis of 176 days of data taken over the winter of 1978-79. Auxiliary heat during this winter was 7.4 million Btu which compares with 66.0 million Btu total heat losses from the house plus 46.4 million Btu losses from the greenhouse. Auxiliary heat predicted using the solar load ratio

method is 8.1 million Btu. Solar savings are estimated as 57 million Btu. Good thermal comfort conditions are documented. Energy flows are tabulated for each month. Energy flows are tabulated for each month. Conclusions regarding detailed heat flow and storage in the house are presented.

**21863 (MCR—81-543) SOLPAS: passive solar algorithms. User's manual.** (Martin Marietta Corp., Denver, CO (USA). Denver Aerospace). Mar 1981. Contract AC01-78CS35243. 189p. NTIS, PC A09/MF A01.

This users' guide documents a library of passive solar heating subroutines that are compatible with the generalized MITAS thermal network analyzer. The objective of the SOLPAS activity has been to develop and document the essential routines needed to perform passive solar simulations with the existing MITAS program. Several example models are described that could be adapted easily to specific user applications. The following are included: SOLPAS basic structure, alphabetical listing of SOLPAS routines; selected MITAS subroutines, and SOLPAS examples. (MHR)

**21864 (MDC-G—8163A) Solar repowering/industrial retrofit systems study Gulf Mt. Taylor Uranium Mill solar retrofit system requirements specification.** Keller, G.L. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Dec 1979. Contract AC03-79SF10608. 40p. NTIS, PC A03/MF A01.

The subsystem characteristics, design requirements, system environmental requirements, plant conceptual design data requirements for a Solar Industrial Retrofit Plant at the Gulf Mt. Taylor Uranium Mill are defined. For the purpose of the industrial retrofit conceptual design project, a retrofit system will consist of the following major elements: site, site facilities, collector subsystem, receiver subsystem, master control subsystem, fossil energy subsystem, energy storage subsystem (if applicable), process steam distribution subsystem, and specialized equipment. A limited functional description of the elements of these subsystems involved in the solar retrofit.

**21865 (NP—1902600) Energy-resource requirements of a solar-heating system.** Rogers, D.W.O. (National Research Council of Canada, Ottawa, Ontario). Feb 1979. 57p. NTIS (US Sales Only), PC A04/MF A01.

The methods of energy analysis have been applied to a liquid-based short-term storage solar space and water heating system suitable for a single family dwelling in Toronto. This system, which in many respects represents a worst case for solar heating, takes 1.0 to 3.5 years of operation to conserve the energy resources required to build, operate and maintain the system. Alternatively, over the twenty year lifetime of the system the energy resources used indirectly by the solar heating system amount to between 6 and 24% of the direct energy resources conserved by the system. These considerations do not significantly alter the energy conservation characteristics of the solar heating system unless thermally generated electricity is used as backup for a 50% solar heating system which replaces oil or gas heating - in this case only 4 to 9% of the energy resources are conserved by going solar. A factor of three variation in energy resource use in collector materials was found in a sample of 7 flat plate collectors with steel based collectors using the least. The total energy embodied in the collector was about double that found in the materials alone. The collectors and annual operating energy for the pumps were found to be the two most significant factors in the analysis. Appendices summarize the energy resource requirements embodied in the materials used for collectors and estimate the total energy resource requirements of conventional fuels delivered to the home.

**21866 (SOLAR/0005--81/80) National solar data program performance results, Volume II.** (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). 1981. Contract AC01-79CS30027. 72p. NTIS, PC A04/MF A01.

Separate abstracts were prepared for the seven included papers on performance of solar heating systems.

**21867 (SOLAR/0005—81/80, pp 1-15) Performance comparison of solar space heating systems of selected active sites in the National Solar Data Network.** Kendall, P.W.; Holte, H.O. 1981. NTIS, PC A04/MF A01.

In National solar data program performance results, Volume II.

The purpose of this paper is to present the most recent composite performance results for selected active solar space heating commercial sites in the National Solar Data Network. Results presented have been developed on the basis of analysis of instrumented sites monitored through the 1979 to 1980 heating season. Sites analyzed in depth include four representative major types of active solar heating systems. A great quantity of individual measurements have been collected and reduced, providing a large reservoir of data for operational and comparative analysis. Parameters and performance indices presented include overall system delivered loads, solar fraction of load, solar savings ratio, coefficient of performance, energy collected and stored, and various subsystem efficiencies. The comparison of these factors has allowed evaluation of the relative performance of various system designs. A matrix of performance indices is presented for comparison of the representative solar heating installations.

**21868 (SOLAR/0005—81/80, pp 15-24) Performance of solar energy hot water systems.** Cramer, M.A.; Evans, K.D.; Rosenbusch, J.M.; Weinstein, R.A. 1981. NTIS, PC A04/MF A01.

In National solar data program performance results, Volume II.

The results of a comparative report of solar energy hot water systems installed in sites monitored by the National Solar Data Network are highlighted. Two single family and 2 multifamily residences were selected to use in this paper. These four systems represent different types of hot water systems: passive hot water, active hot water with space heating, hot water with recirculation, and hot water thermosiphon. A comparative analysis is presented by a series of charts and figures, as well as a narrative explanation. The data is provided in a number of forms including average monthly performance values for each hot water system, average monthly values for the summer and winter seasons, and estimated operational dollar savings. The conclusions are directed at both solar and conventional design features that cause good or bad performance.

**21869 (SOLAR/0005—81/80, pp 25-29) Long-term performance trends for ten solar systems monitored by the national solar data network.** Doak, L.; Gervasio, C. 1981. NTIS, PC A04/MF A01.

In National solar data program performance results, Volume II.

Performance of ten solar sites in the National Solar Data Network (NSDN) are plotted over periods of two to three years. Performance trends for collector array, and the energy collection and storage subsystems are presented. Comparisons are made between performance trends for air and liquid collectors, and between active and passive systems. The report also offers observations on causes for trends over several years of operation.

**21870 (SOLAR/0005—81/80, pp 31-38) Analysis, simulation and diagnosis of solar energy control system anomalies.** Waterman, R.E. 1981. NTIS, PC A04/MF A01.

In National solar data program performance results, Volume II.

Control system anomalies are examined and an attempt is made to quantify the resultant system performance characteristics and economic consequences. The study methods employed to investigate and diagnose controller malfunctions involve a blend of mathematical modelling and analysis of long term data from three solar homes in the National Solar Data Network. The diagnostic methods and results of this study should be of immediate practical value to designers, installers and owners concerned with obtaining maximum performance from their solar energy systems.

**21871 (SOLAR/0005—81/80, pp 39-44) Hourly use profiles for solar domestic hot water heaters in the National Solar Data Network.** Barvir, E.J.; Doak, L.G.; Waterman, R.E.; Gervasio, C. 1981. NTIS, PC A04/MF A01.

In National solar data program performance results, Volume II.

Daily hot water rates of consumption and the Hourly Profiles of Daily Hot Water Consumption for single and multiple family dwellings are provided in this paper. These new statistics obtained from the National Solar Data Network (NSDN) are significantly different from the statistics currently being used in TRNSYS, SOLCOST and F-Chart. The NSDN statistics suggest that both the daily demand and hourly use profiles used in performance models should be revised.

21872 (SOLAR/0005—81/80, pp 45-57) **Assessment of air solar system performance with alternate methods of analysis.** Taylor, S.L. 1981. NTIS, PC A04/MF A01.

In National solar data program performance results, Volume II.

As an alternative to using detailed measurements to determine the energy losses of an active air solar system, the solar space heating contribution of solar systems may be evaluated using the building as the control volume for the analysis. The method can also assess solar performance using a minimum of instrumentation. A second method, used by some designers, for active solar system performance is presented which uses modified degree day design. It uses only the active space heating system as the control volume for the analysis. Discrepancies in the results suggest that space heating designers consider all heating energy flows into the building and not just the active space heating system.

21873 (SOLAR/0005—81/80, pp 59-66) **Validation of remotely sensed data from a large network of solar heating and cooling installations.** Kelly, C.J. Jr. 1981. NTIS, PC A04/MF A01.

In National solar data program performance results, Volume II.

In a large network of solar heating and cooling installations where data is gathered over a telephone network, it is not feasible to inspect sensors daily or even weekly nor frequently to calibrate instruments on site. The geographic expanse makes regular vists by technicians prohibitively expensive. The buildings are occupied and many are residences. Frequent intrusions by technicians are usually unacceptable. Therefore, other methods must be used to ensure that published results, using these data, are accurate and reliable. These methods are divided into two phases - data screening and performance factor validation. Performance factors are the numerical results of performance evaluations of the individual installations. Data screening consists of determining that the gathered data are reasonable with regard to magnitude, rate of change and relationship to other sensor outputs. Performance factor validation consists of constructing energy balances using different groups of sensors or analysis techniques and comparing the results. This validation does not verify individual sensor accuracy but rather confirms the energy flow calculations to standards which may vary for each system. Using these methods, inaccurate or inoperable sensors can be discovered with a high degree of confidence. These validation methods are described and use of them on data gathered from a large scale data network is detailed with examples of the types of anomalies discovered.

21874 **(SOLAR/1025—81/50) Solar project description for Helio-Thermics, Inc., Lot 6 single family residence; Greenville, South Carolina.** Moore, D. (Boeing Co., Seattle, WA (USA)). 19 Mar 1981. Contract AB01-76CS31020. 58p. NTIS, PC A04/MF A01.

An instrumented single-family residence in Greenville, South Carolina, has approximately 1086 square feet of conditioned space. Solar energy is used for space heating the home and preheating domestic hot water (DHW). Solar energy enters the attic through a 416-square-foot aperture which is double-glazed with corrugated, translucent, fiberglass-reinforced, acrylic panels. Warm air accumulates in the peak of the attic roof and circulates through the conditioned space or through storage by an air handler. Solar energy is stored in an 870 cubic foot storage bin containing 85,460 pounds of crushed rock located under the house. Cold water is preheated in the attic by thermosiphoning water from the 80-gallon preheat tank through a manifold system of copper tubes. These tubes are attached to black sheet-metal plates. Preheated city water is stored in the preheat tank and supplied, on demand, to a conventional 80-gallon DHW tank. When solar energy is insufficient to satisfy the space heating load, a water-to-air heat exchanger in the hot air supply-duct provides auxiliary energy for space heating. A gas-fired water heater provides auxiliary energy for the water-to-air heat exchanger and the DHW. Thermal energy storage is provided by 870 cubic feet of crushed granite located beneath the floor of the house. Air flow through the storage chamber is horizontal, flowing from the center of storage to return registers adjacent to the north and south walls of the house.

21875 **(SOLAR/1039—81/14) Saddle Hill Trust Lot 73, Medway, Massachusetts: solar energy system performance evaluation, January 1980-December 1980.** Brauch, M.L. (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). 1980. Contract AC01-79CS30027. 81p. NTIS, PC A05/MF A01.

The Saddle Hill Trust Lot 73 site is a single family residence in Medway, Massachusetts. The solar energy system is designed to supply 54% of the 18.70 million BTU hot water load. It is equipped with 45 square feet of solar collection area, an 80-gallon preheat storage tank, and a gas-fired, 40-gallon auxiliary domestic hot water tank. Problems with the data communication system and with a pyranometer are reported. Data are given describing the overall system performance energy savings, and solar energy utilization. Performance data are given for the collector, storage, and domestic hot water subsystems, as are the system operating energy and site weather conditions. Performance evalation techniques and sensor technology are briefly described. (LEW)

21876 **(SOLAR/1050—81/14) Solar energy system performance evaluation, October 1979-April 1980: Bond Construction, Gladstone, Missouri.** Ashman, E.N. (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). 1980. Contract AC01-79CS30027. 84p. NTIS, PC A05/MF A01.

This active solar system uses 465 $ft^2$ of liquid flat plate collectors and an 800-gallon steel tank for storage. The system was designed to provide 58% of the heating load and 85% of the hot water. Due to control and equipment problems, the system supplied 16% of the space heating and 48% of the domestic hot water requirements during times when the system operated. (MHR)

21877 **(UCID—18893) Status report on the project for a standardized data acquisition system.** Bush, G. (Lawrence Livermore National Lab., CA (USA)). 13 Apr 1981. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01.

Data acquisition systems for industrial process heat field tests are explored. The system selection, specifications, and prototype selection process are reviewed. (MHR)

21878 **Agricultural energy. Vol. 1. Solar energy livestock production.** St. Joseph, MI; American Society of Agricultural Engineers (1981). 282p. (CONF-8009144—(Vol.1)). $49.50 per set.

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

Forty-nine papers and twenty-three abstracts are included. A separate abstract was prepared for each paper and the abstracts were listed by title. (MHR)

21879 **Corn drying with solar-dried desiccant.** Bern, C.J.; Anderson, M.E.; Monson, M.J.; Wilcke, W.F. (Iowa State Univ., Ames). pp 89-94 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineers (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

A combination desiccant/low temperature drying system was designed and compared in field tests with a conventional low-temperature system. The desiccant system uses solar heat to overdry corn during summer for later use as a desiccant to be mixed with wet corn. Electrical energy use and electrical demand for the desiccant system averaged 31 and 13%, respectively, of that required for the conventional system. Annual net costs per unit capacity were estimated to be about the same for both systems.

**21880 Performance of an experimental annual cycle solar regenerated desiccant crop dryer.** Fletcher, J.W. (Lockheed-Huntsville Research & Engineering Center, Alabama). pp 95-99 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineers (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

An analytical and experimental study on annual cycle solar regeneration of desiccants for crop drying is discussed. Operational data (regeneration and drying) are presented that were obtained from a small scale experimental system over a two-year period. The concept was initiated to economically meet on-farm drying requirements with solar energy and to eliminate the farmer's dependence upon availability of fossil fuels. The crop is dried in a closed loop system with low temperature, dehumidified air and at a rate comparable to conventional fossil fuel dryers. Drying energy is stored in the form of concentrated liquid desiccant, regenerated by solar energy during the year preceding the drying period. The system makes use of a single multi-purpose unit that not only collects and stores the solar energy during regeneration, but also dehumidifies the air to the crop during drying. In addition to this unit, a small inexpensive solar air pre-heater is used to increase the regeneration rate. This system has been shown to be very versatile, in that a variety of crops (soybeans, peanuts, and corn) have been dried with no modification. Drying tests have even been performed in the rain, with excellent results, demonstrating the advantage of a closed loop drying system. In addition, a conventional fuel backup system is not required with this system, and only a small amount of auxiliary energy is needed.

**21881 Predicted performance of the KSU solar collector-storage system.** Robbins, F.V.; Spillman, C.K. pp 160-165 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineering (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

Research on an inexpensive system developed to supply supplemental heat to livestock shelters by heating the ventilating air is summarized. The system, the measured performance of the prototype unit, and the measured performance of two commercial swine farrowing buildings equipped with solar collector-storage units are described. But mainly the mathematical model of the solar collection system which was a major portion of the recent research effort is described. The model is a combined simulation of the solar collection system and a swine farrowing house which it heats. This model is used to predict annual collector performance at different locations in the United States. Results of several simulations for solar collector-equipped farrowing buildings at two locations are presented to illustrate how the simulation can be used.

**21882 Solar space heating a growing-finishing swine building without added thermal storage.** DeShazer, J.A.; Schulte, D.D.; Moser, B.D.; Bodman, G.R. (Univ. of Nebraska, Lincoln). pp 166-170 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineering (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

The effectiveness of using a solar system without storage to conserve the use of conventional energy in a naturally ventilated swine growing-finishing building was evaluated in field studies and mathematical simulation. The solar system reduced the electrical energy needed by 25% in the field test and 23% in the mathematical simulation. The percent of utilization of the delivered solar energy for heating a building with an exposure factor of 2.3 W/C pig varied from 17% in the field during mild weather conditions to 43% simulated under cold weather conditions. A decrease of the building exposure factor to 1.4 W/C pig, decreased the simulated utilization to 30% under cold weather conditions. During the field test heating season, the predicted energy required to operate the solar system distribution fan was 72% of the heat saving from use of solar heating. Therefore, under field conditions, a net reduction of only 7% was realized in the electrical energy requirement for a solar heated growing-finishing building without added thermal storage.

**21883 Solar poultry brooding research at the Southeast Poultry Research Laboratory: a progress report.** Drury, L.N.; Mitchell, B.W.; Beard, C.W. (Dept. of Agriculture, Athens, GA). pp 228-235 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineers (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

A solar poultry brooding research facility has been designed, built, equipped, and instrumented at the Southeast Poultry Research Laboratory. The facility consists of three adjacent buildings (a solar building and two 87-$m^2$ broiler houses), two similar water-based systems for collecting, storing, and using solar energy, and a data acquisition system. The goals of our research in this area are to determine the functional requirements of and establish design criteria for practical solar brooding systems. Six chick brooding trials, in which three types of solar brooding equipment were used, have been completed. The data from four of these trials have been analyzed and are presented and discussed in this report. The overall solar fraction of the total brooder heat was about 65%, the overall collector efficiency was about 33%, and the average utilization factor for the solar energy collected within a brooding trial was about 75%.

**21884 Solar heating of poultry laying houses in the northern states.** Hall, F.; Esmay, M.; Gardjito; Haney, R.; Flegal, C. pp 242-246 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineers (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

An air medium, 90.6 $m^2$, solar collector was designed and constructed in 1976 at East Lansing, Michigan, to provide supplement heat for a 5000 bird, cage-layer house. The collector had a fixed position tilted 60° from the horizontal towards the south for optimum solar energy collection from the 42° north latitude low winter sun. To minimize the initial cost the collector was constructed of common farm building materials of treated poles, dimension lumber, plywood, black painted aluminum roofing material, blanket insulation, and glass. During three years of collector operation the operational efficiencies ranged between 40 and 75%. The utilization of solar energy when available made it possible to maintain a continuous in-house temperature near 20°C without an undesirably high humidity level. Temperature stratification between the top and bottom decks of the three tier cage system ranged from 2 to 6°C during the winter months. The higher ventilation air exchange possible during periods of good solar radiation held the temperature stratification to the minimum of 2°C. Even though solar energy was not available during the night hours there was evidence of some carry over affect of the daytime fecal drying by the additional solar heated air exchange. Some exchange of latent for sensible energy during the non-solar energy hours helped maintain acceptable humidity levels with the available body heat from the birds. Estimates of feed savings due to the higher in-house temperatures indicated a collector pay back in about five years.

**21885 5th national passive solar conference.** Hayes, J.; Snyder, R. (eds.). Newark, DE; American Section of the International Solar Energy Society, Inc. (1980). 718p. (CONF-801016—(Vol.2)). NTIS, PC A99/MF A01.

From 5. national passive solar conference; Amherst, MA, USA (19 Oct 1980).

One hundred and fifty seven papers are included. Five were abstracted previously. Separate abstracts were prepared for one hundred and fifty two papers. (MHR)

**21886 Heat transfer in passively cooled buildings.** Haves, P.; Bentley, D.; Clark, G. (Trinity Univ., San Antonio, TX). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 707-711(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Studies of the cooling rates obtained by evaporation and radiation to the night sky from horizontal surfaces indicate that passive cooling could meet a large proporation of the sensible cooling loads of residential and commercial buildings in the United States.

Systems in which the roof acts as the heat dissipating surface have the dual advantage of being well coupled to the sky and not adding the water vapor produced by evaporative cooling to the air in the building, thus extending their applicability to the more humid areas of the country. Comparisons of the simulated performance of several alternative systems of coupling the roof to the thermal storage and to the people are presented. The heat transfer processes operating in four different designs are discussed. Thermal simulation assumptions are listed and uncertanties noted. Simulation results are presented for three systems in San Antonio and for one system in Miami and Phoenix. The roof pond system was found to have the best thermal performance; this is attributed to the negligible thermal resistance between the dissipating surface and the storage, and effective heat transfer by both radiation and natural air convection between storage and the space. However, thermal coupling of the dissipator and the storage by pumped water and by a combination of radiation and natural air convection also proved effective.

21887 **Design considerations for solar dehumidifiers.** Arnold, F.H.; Barlow, R.S.; Collier, R.K. (Solar Energy Research Inst., Golden, CO). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 712-716(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The basic principles of solar desiccant dehumidification are reviewed; approximate sizing methods for passive/hybrid systems are presented; and potential problem areas are identified. (MHR)

21888 **Measurements and simulations of radiative cooling through IR transparent windscreens.** Manning, R.; Clark, G.; Rudzki, J.; Blanpied, M. (Trinity Univ., San Antonio, TX). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 717-721(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Net heat dissipation rates from horizontal radiators have been measured. Graphs of heat dissipation rates are presented for an exposed radiator and for radiators glazed with 3 different polymer windscreens. Measured heat dissipation is compared with a computer simulation estimate for a radiator glazed with polyethylene.

21889 **Passive nocturnal cooling resource assessment using validated heat transfer equations.** Loxsom, F.M.; Kelly, B. (Trinity Univ., San Antonio, TX). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 727-731(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Accurate simulations of passively cooled buildings require validated cooling rate equations. Uncertainty in the convective heat transfer coefficient leads to a corresponding uncertainty in net nocturnal heat loss from a wetted surface. Because in passive systems dry surfaces lose heat primarily by radiation, accurate convective heat transfer equations are less important for dry surfaces. A thermal test facility consisting of 2 identical 800 square foot buildings is currently under construction on the Trinity campus. These buildings are designed as a flexible test facility for the testing of a wide range of passive systems. Using this facility, heat transfer coefficients for residence sized structures can be determinded with an accuracy of $^{+-}$ 10%.

21890 **Passive ventilation of an underground bath house by the use of solar chimney.** Ahmed, S.F.; Barnes, S.R. (Burt Hill Kosar Rittelmann Associates, Butler, PA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 752-756(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

An underground bath house in Western Pennsylvania is designed to have passive ventilation provided by a solar chimney. The bath house is to be used in the afternoons and during the summer months only and is not heated or cooled. A mathematical model has been developed to predict the ventilation rate provided by the absorption of solar energy on the inside surface of a tall chimney. The effect of wind on the ventilation rate by buoyancy forces has also been investigated. The solar chimney also provides some lighting need of the present facility.

21891 **Passive education for active professionals: a review of the effectiveness of the passive studio.** Bremer, D.S. (AIA Research Corporation, Washington, DC). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 800-803(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

A training program was developed for practicing architects and engineers and tested it during the Spring of 1980. The objective of the Passive Studio is to enable the participants to learn the specific needs of designing for various building types and climates and learn how to apply passive techniques in their practices. The Studio attracted over 400 professionals and was held in eight major cities around the country. A program of evaluation was used to document the effectiveness of the Passive Studio at achieving this objective. This testing and evaluation program led to improvements in the workshop and materials. Indications are that in three years firms of Studio participants will be designing passive building worth over $1 billion per year. Over eighty percent of these participants have already implemented passive design techniques in actual building designs in the first three months following the workshops.

21892 **Overcoming the non-technical barriers to the acceptance and utilization of passive solar energy through education and promotional activities.** Dubester, L. (Center for Ecological Technology, Pittsfield, MA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 814-818(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The ways that the Center for Ecological Technology (CET), a non-profit educational and research organization dealing with energy issues in Berkshire County, demonstrated these systems through education and promotional programs are discussed. This community education paper documents mistakes, successes and lessons learned so others can make use of CET's experience in following up on demonstration protects.

21893 **Solar cities and towns program.** DeSerio, F. (Dept. of Energy, Washington, DC). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 832-835(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

An overview of the Department of Energy's new Solar Cities and Towns Program is provided. Its focus is on those renewable energy technology and design approaches which benefit from large scale, multiple-building applications. Such projects are facilitated by urban densities within single municipal juridictions. Its initial emphasis is on passive and hybrid solar commercial and multifamily applications. Funding will be provided for developers and cooperatives functioning as developers. Allowable costs include feasibility and design studies, management, communication, and education by the developer of local government and financial sector officials. Education and implementation materials supporting these tasks will be developed from existing publications and consolidated into Town Kits. Under DOE enhanced budget options, cost sharing of construction costs will also be provided. Examples of selected projects are included.

21894 **Ecomomic implications of a passive solar retrofit program in Albuquerque, New Mexico.** Martin, S. (Univ. of New Mexico, Albuquerque); Noll, S.A.; Roach, F. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 841-845(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Preliminary results of a study to estimate the potential impacts of a community based residential passive solar retrofit program in Albuquerque, New Mexico are presented. The analysis utilizes survey data collected from local residents; the 1972 Input/Output Model of the United States; and actual material and labor costs for three passive solar systems - a greenhouse, Trombe wall and Morse wall. Reported results include total potential retrofittable housing stock, community income and employment effects, and projected community energy savings.

**21895 Design of passive commercial buildings: major lessons learned.** Kurkowski, T.L.; Ternoey, S.E. (Dept. of Energy, Chicago, IL). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 856-858(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The DOE Passive Commercial Building Program includes some of the best passive designers in this country. The lessons learned by and advice traded among the participants is presented.

**21896 Strategies for the use of passive solar approaches in commercial buildings.** Gordon, H.T. (Rittelmann Associates, Washington, DC); Kosar, B.H.; Whiddon, W.I. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 859-863(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The organization and procedure of DOE's Passive Solar Commercial Design Demonstration Program is described. The current status of the 33 projects is given. Preliminary data collected to date are presented. (MHR)

**21897 Passive solar retrofit of all glass office buildings.** Loftness, V. (Dubin-Bloome Associates, New York, NY); Hartkopf, V.; Hoffman, L. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 869-873(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The energy conservation and passive solar analysis and retrofit of the CMU Administration Building - Warner Hall is discussed. The step-by-step procedure developed to achieve the retrofit of this all-glass office building is described herein to give owners and managers of any glass office building (from 6 to 60 stories high) the audit approach to energy conservation and passive solar retrofit design.

**21898 Moving passive into the mass market: the Acorn/ Massdesign passive prototype.** Ingersoll, T.G. (Massdesign Architects and Planners, Inc., Cambridge, MA); Tully, G.F.; Kelley, M.E. III. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 879-883(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Acorn Structures, Inc., manufacturers of pre-fab homes, teamed with Massdesign Architects and Planners, Inc. in mid-1979 to participate in a cost-sharing program under the Solar Passive and Hybrid Manufacturing Buildings Program. Since Acorn sells in the mass market, the designs were generated within the marketing and construction constraints typical of mass-market builders. The design response to these constraints is a series of homes, graded in cost, all two stories, three bedrooms, with all major spaces facing south. As the buildings increase in cost, the amount of south glazing increases, along with the storage necessary to serve the enhanced passive gain. The plans, typical of Acorn homes, are compact, carefully thought out, with attention to privacy, good circulation, visually interesting spaces and good exterior elevations.

**21899 Passive solar manufactured buildings for commercial applications.** Keller, B.M. (Structures Unlimited, Inc., Manchester, NH); Sedrick, V. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 889-893(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The thermal performance, annual energy requirements and costs of two passive solar manufactured commercial building designs are analyzed. Unique features of these 930 $m^2$ (10,000 $ft^2$) floor area designs include: highly insulated, light transmitting walls and roof, a tranlucent phase change material thermal storage system, multiple layer solar windows and low cost movable insulation system. Results of these analyses show that: 1) annual total energy consumption of the solar buildings is reduced by up to 69% compared to proposed Federal Building Energy Performance Standards (BEPS); 2) Passive daylighting reduces electric lighting energy by 86% and 3) Cost-effective designs are highly dependent on the buildings use and occupancy. Estimated cost payback periods for these solar designs range from 6.5 to 7.5 years.

**21900 Passive solar manufactured buildings program: useful model for government efforts to assist industry.** Baccei, B.; deKieffer, R.; Brant, S. (Solar Energy Research Inst., Golden, CO). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 894-896(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The progress of the Manufactured Buildings Program initiated by the Solar Energy Research Institute (SERI) and the Department of Energy (DOE) is presented. The model which this program provides for government working with industry is also discussed.

**21901 Genesis: the solar community.** Kawecki, J.J. (Solar Architect and Builder, Columbus, OH). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 929-932(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Descriptions and drawings of seven homes in the first all passive subdivision to be constructed in Ohio are presented. (MHR)

**21902 Indoor air pollution in passive structures.** Scott, L.A. (St. Olaf Coll., Northfield, MN); Scott, M.G. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 960-964(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Indoor generated pollutants from combustion, building materials and human activities may reach significant levels in the indoor environment to produce adverse health effects. The classes of pollutants, their sources, and the significance of reported levels, possible health effects, and control strategies in relation to passive solar construction techniques are presented. It is recommended that further research be implemented to identify hazardous concentrations of pollutants and set standards to minimize health impacts in the search for new energy innovations.

**21903 Bottom line: comments on incremental costs in the Massachusetts multi-family passive solar housing program.** Shannon, R.F. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 965-969(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

As part of its ongoing Passive Solar Multifamily Housing Program, the Office of Energy Resources performs detailed in-house estimates of incremental passive solar and conservation costs. These estimates are part of an iterative design reviewing process and are used to minimize costs while assuring good system performance. The Office of Energy Resources will finance approved energy conservation and passive solar features in over 20 elderly housing projects presently in various stages of design and construction. Experience gained refining cost-effective designs of these projects is discussed. The discussion includes: isolating and analyzing incremental costs, accruing credits for downsized heating systems, and accounting for soft variables such as additional space and architectural amenity. Cost implications of system type, building scale and geometry, and construction details are outlined, and incremental costs for several specific designs are presented in detail. Much of this information should be applicable to design for single-family and commercial buildings, as well as multi-family housing.

**21904 Determination of thermal performance characteristics of modular passive solar storage walls.** Kennish, W.J. (TPI, Inc., Beltsville, MD); Ahmed, M.; McCabe, M.; McKinstry, M. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 975-979(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

A conceptual study of testing procedures to determine thermal performance characteristics of Trombe-Wall type passive solar storage wall systems has been performed. In the study, a finite-difference thermal model of a passive solar storage wall in a test facility was used to predict the wall thermal performance in a particular climatic location. The simulated test results were used in a multiple regression analysis to characterize the thermal performance of test wall. These characteristics were then used in a simplified calculation procedure to predict the thermal performance of the solar stor-

age wall in different climatic regions. A comparison of these predictions with detailed computer simulation results for these other climatic regions show that the test procedure and data reduction technique provides a simple method of characterizing the passive solar storage wall and has potential wide scale applications for modular passive components.

21905 **Windows for accepting or rejecting solar heat gain.** Peck, J.; Thompson, T.L.; Kessler, H.J. (Univ. of Arizona, Tucson). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 985-989(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Ordinary windows may be modified at low cost using various combinations of windows, duotone venetian blinds, and drapes to control the solar heat gain. In the winter, solar radiation may be absorbed by dark blinds and transferred to the air, minimizing fading of furnishings while collecting useful energy. In the summer, 95 percent of the total potential window heat gain may be rejected by exhausting evaporatively cooled air over the blinds.

21906 **Klegecell: a new lightweight insulating material with superior properties.** Hodges, L. (Iowa State Univ., Ames). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1003-1006(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Klegecell -- the brand name of a rigid polyvinyl chloride foam used extensively in the marine and aviation industries -- has substantial advantages over other rigid insulation for certain passive solar applications, particularly as movable insulation. It comes in lightweight rigid panels with high insulating values (R = 7 per inch) so that thin panels are adequate. Its low water vapor permeability makes it suitable for use on the inside of glazing in cold climates, since it prevents condensation from occurring. Its nonflammability is a particularly desirable property for interior use.

21907 **Two innovative passive air thermosiphon houses in Santa Fe.** Jones, M.M. (Mark Jones Corp., Santa Fe, NM); Morris, W.S. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1051-1055(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Two new passive air thermosiphon heated homes are compared. The two houses utilize similar collectors, and are located near each other in Santa Fe, New Mexico. The two differ in geometry of storage. The first utilizes narrow vertical rockbeds internal to the building and arranged as room dividers. The second uses an underfloor rockbed below the entire heated area. Both systems operate without fans and heat the space by radiation from the walls/floor rather than direct airflow to the space. Both systems are designed for 75% SHF in ~ 2000 ft² homes. The systems are compared based on design data and preliminary operating test data from one of the systems. From a review of the literature, it appears that these are the first full-scale built examples of either type of convective collector/rockbed geometry which have been reported.

21908 **Analysis and performance evaluation of an air thermosyphon system.** Marshall, L.S.; Burns, P.J.; Winn, C.B. (Colorado State Univ., Fort Collins). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1056-1060(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The study deals with the analysis and simulation development of an air thermosyphon system. The physical system consists of a double glazed collector, ducting, backdraft dampers to prevent reverse circulation of the air, and a rock box in the north wall for thermal storage. A simulation scheme has been developed to conduct a preliminary system evaluation. The simulation makes use of an improved Euler technique to solve the transient energy and momentum equations. The formulation of the analytical model for the system is presented. Simulation results and the variation of system parameters are also analyzed.

21909 **PDL-24 solar monitoring system.** Halperin, D.A. (Aeolian Kinetics, Providence, RI). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1114-1118(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

SERI begins the Class B passive solar performance evaluation this fall. A standardized data acquisition system, the Aeolian Kinetics PDL-24 solar Monitoring System, will be used. The system's features, capability, and operation are described.

21910 **Qualitative approach to performance evaluation of passive solar residences.** Sachs, B. (Memphremagog Group, Newport, VT); Towle, S. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1215-1218(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Passive and hybrid systems performance evaluation is being undertaken nationally to support both system development and market development data and information needs through a coordinated program of both quantitative and qualitative research. This paper will focus on the more qualitative effort: the collection of non-instrumented data from passive solar residences. This qualitative performance evaluation will provide data on the overall energy use of passive/hybrid buildings. It will also provide non-instrumented data relevant to thermal performance, reliability, durability, safety, cost, and user acceptance.

21911 **Comfort conditions in roof pond cooled residences without air conditioners.** Clark, G.; Allen, C.P. (Trinity Univ., San Antonio, TX). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1224-1228(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Comfort conditions in the Skytherm type roof pond residences are simulated. The residence is vented when the ambient air is cooler than interior air and interior air is circulated otherwise. Hourly distributions of comfort conditions are calculated using Fanger's PMV index. Wet and dry roof residences are simulated in four cites for both typical and extremely hot July periods. Wet roof comfort conditions are acceptable even during an extremely hot summer if convective coupling to the ceiling is enhanced by air motion.

21912 **Design of a super-insulated energy education center.** Kinney, L.F. (Syracuse Research Corp., NY); Ashley, D.C.; Ashley, C.M. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1284-1288(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The Syracuse Research Corporation has designed a passively solar heated Energy Education Center for Syracuse, New York. In spite of the fact that Syracuse has severe winters (6,700 heating degree days and average snowfall of 103 inches) and very poor insolation (20% possible in December and January), the 55,000 square foot building is expected to achieve superior energy performance. The predicted energy totals for heating, cooling, lighting, and fan power are less than 10,000 Btu's per square foot per year. The design makes full use of the concepts of super insulation: R-40 insulation in the walls from the roof to below the frost level, R-80 ceiling insulation, berming where appropriate, insulating shutters, and a positive heat exchange system for ventilation. A comparatively small amount of south-facing glazing is requided to add cyclical heat by insolation. The super insulation design concept requires that infiltration be kept at a minimum. Thus, the design calls for double entry ways, careful construction techniques, and a total heat exchanger to control humidity, as well as save sensible heat for the ventilation air system.

21913 **Massachusetts multi-family passive solar housing program.** Rouse, R.E.; Shannon, R.F. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1289-1291(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

A unique combination of Federal, State, and Local resources and initiative is producing energy-efficient/passive solar elderly housing in Massachusetts. The program, developed at and managed

by the Massachusetts Executive Office of Energy Resources, is using $2.5 million of state energy bonding authority to finance incremental costs of energy conservation and passive solar features in state-financed local housing projects. The design and technical assistance, incremental cost estimating, and public outreach portions of the program have been made possible under a grant from the US Department of Energy (through NESEC) as part of the Solar Cities Program. The program includes both new projects and retrofits, with building types ranging from mid-rise, high density urban structures to two-story suburban townhouses. Seventeen project, including over 400 passive solar units, are in working drawings or out to bid and more are in concept development. It is anticipated that present funding will ultimately permit construction of as many as 800 passive solar heated apartments. On the average, these projects will use only 25% of the energy required to heat a similar building of conventional design.

**21914 Swimming pool heating.** Talwar, R. (Mid-American Solar Energy Complex, Minneapolis, MN). pp 15-31 of Solar energy technology handbook. Part B. Applications, systems design, and economics. Dickinson, W.C.; Cheremisinoff, P.N. (eds.). New York, NY; Marcel Dekker, Inc. (1980).

The operation, sizing, installation, and costs of solar heating systems for swimming pools are discussed. Equations for calculating heat gains and heat losses and the overall energy balance for solar heated pools are given. Also the performance of pool covers is described. (WHK)

**21915 Building space heating: active systems.** Hunn, B.D. (Los Alamos Scientific Lab., NM); Loef, G.O.G. pp 33-102 of Solar energy technology handbook. Part B. Applications, systems design, and economics. Dickinson, W.C.; Cheremisinoff, P.N. (eds.). New York, NY; Marcel Dekker, Inc. (1980).

Details of the design, operation, and performance of solar space heating systems including liquid heating systems, air heating systems, and solar heat pump combinations are presented. System performance prediction and the various design parameters are discussed. Performance results of three installed systems are summarized: CSUI and CSUII residences at Colorado State University and the National Security and Resources Study Center at the Los Alamos Scientific Laboratory. (WHK)

**21916 Industrial process heat.** Dickinson, W.C.; Casamajor, A.B. (Univ. of California, Livermore). pp 297-311 of Solar energy technology handbook. Part B. Applications, systems design, and economics. Dickinson, W.C.; Cheremisinoff, P.N. (eds.). New York, NY; Marcel Dekker, Inc. (1980).

The possibilities of using solar energy for providing industrial process heat are discussed, including problems and drawbacks. DOE-funded prototype solar process heat systems are described. Solar industrial process heat economics, land use, and engineering are considered. (WHK)

**21917 Design and installation considerations for refrigerant charged thermosyphoning solar DHW systems.** DeAngelis, M.; Nordham, D. (Solar Energy Research Inst., Golden, CO). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 779-783(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The recent introduction of refrigerants into the realm of passive solar technologies has provided some advantages in performance over the typical liquid solar domestic hot water system. These advantages can be offset by the lack of familiarity by designers or installers with the operation, layout or components of a phase-change thermosyphon water heater. The considerations which were evaluated in the design and installation of a passive solar domestic hot water system in Golden, Colorado, are described. A discussion of collector selection, storage and heat exchanger design, refrigerant type selection, system integration design, and refrigeration requirements is presented.

**21918 Performance of the solarium-assisted dormitory at the White Mountain School, Littleton, NH.** Hall-Martindale, M.; Converse, A.O. (Dartmouth College, Hanover, NH). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 789-793(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The performance of a hybrid solarium-based heating system is discussed. Over the period 16 October 1979 to 12 March 1980 the solarium collection efficiency was 18.1%, with a daily high of 37.8% on 3 March 1980. The buffering action of the solarium is significant, contributing an energy savings of 144 gal oil equivalent (24% of the actual oil usage). The rock bed storage and associated ducts have a heat loss larger than expected, delivering to the building only 23% of the energy collected in the solarium. Insolation and temperatures are shown for a three-day period; corresponding values for a ten-day period are available for simulation studies.

**21919 Williamson house as simulated by the DEROB system: a field validation.** Wysocki, M.D.; Arumi-Noe, F.N.; Chabannes, G. (Univ. of Texas, Austin). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 794-798(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Hourly temperature data for the Williamson residence, a direct gain, passive solar house in Santa Fe, New Mexico, were simulated by the DEROB System, a flexible set of Fortran programs for the dynamic simulation of the thermal performance of passive solar buildings of arbitrary geometries. The simulation was run on the CDC Dual Cyber 170/750 computer at the University of Texas at Austin. The results of the simulation were matched against hourly thermal performance data collected at the Williamson house site. The simulation results were compared with 7 days of data corresponding to the period from December 26, 1978 through January 1, 1979. Results of the simulation showed that the predicted temperatures for internal and external walls were very closely correlated with the recorded values. The simulated clerestory volume temperatures also showed close approximation to the recorded globe temperature, with most predictions falling within 4.2°C of the recorded values.

**21920 Natural convection in room geometries.** Gadgil, A. (Lawrence Berkeley Lab., CA); Bauman, F.; Kammerud, R.; Ruberg, K. Contract W-7405-ENG-48. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 808-815(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

In spite of the fundamental role played by natural convection heat transfer processes in the operation of passive solar heating and cooling systems, relatively little quantitative information currently exists. The objectives of the work reported are (1) to develop and validate an analysis capability that can be used to examine the contribution of natural convection to the thermal performance of buildings and (2) to utilize the analysis capability to study the influence of natural convection on the thermal performance of single zone passive solar systems. The results indicate that some of the convective coefficients can be substantially different from those assumed by the standard building energy analysis methods, and can exhibit significant variations across a given surface. It is also found that despite these variations, the resulting changes in the zone air temperature and the mean radiant temperature are small.

**21921 Human comfort and auxiliary control considerations in passive solar structures.** Place, W. (Lawrence Berkeley Lab., CA); Andersson, B.; Carroll, W.; Curtis, B.; Kammerud, R.; Christensen, C.; Hannifan, M. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 821-825(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The energy consumption implications of various passive solar and energy conservation strategies are investigated for single-family, slab-on-grade residences in Albuquerque (ALB) and Washington, DC (WDC). The building energy analysis computer program BLAST is used to perform annual dynamic heating and cooling load calculations for a building in which the glazing area, glazing location, and wall mass are varied systematically. The thermal impacts of forced-flow ventilative cooling and nighttime and week-

day thermostat setpoint adjustments are investigated. A weighted average of air temperature and mean radiant temperature is used to evaluate comfort conditions under various circumstances.

21922 **Effect of air flow rate in collector-storage walls.** Utzinger, D.M.; Mitchell, J.W. (Univ. of Wisconsin, Madison). Contract AS02-76CS32588. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 831-835(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

A one-dimensional thermal circuit network model of the collector-storage wall is developed based on the energy balances of the collector-storage wall and the building. This one-dimensional model is compared with a two-dimensional model to determine the effects of nonuniform heat flow through the wall. The results show that a one-dimensional model, which assumes that the air temperature varies exponentially in the flow direction, gives excellent agreement compared with the two-dimensional model. The one-dimensional model is used to determine the effects of air flow rate and gap heat transfer coefficient on the auxiliary heating energy consumption. It is found that auxiliary heating requirements are not significantly affected by air flow in the gap.

21923 **International passive architectural survey: preliminary analysis.** Diachok, D. (Solar Energy Research Inst., Golden, CO); Shanks, D. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 836-840(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

An international survey of Research, Development and Demonstration in the passive solar design field was undertaken as a joint venture by the Solar Energy Research Institute's Passive Technology Program and by D.D. Shanks and Associates. The world was divided into 12 geocultural regions based on cultural and geoclimatic similarities. Each such region was treated individually to evaluate three variables: (1) the level of awareness of passive solar design, (2) major areas of concentration of RD and D, and (3) expressed interest in specific areas of information exchange. A series of questionnaires formulated for six different occupational groups was mailed throughout the world. A literature search of international passive design work complemented the analysis of the survey responses. The three variables were found to vary widely among the geocultural regions. A preliminary analysis of the ongoing survey is given.

21924 **Eliminating peak load auxiliary energy use in passive solar residences during winter.** Sebald, A.V. (Univ. of California, San Diego); Munoz, D. Contract AC04-79AL10891. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 855-859(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

This paper uses simulation analysis in Albuquerque, NM, Santa Maria, CA and Madison, WI to address the following four questions. (1) Assuming a properly designed and controlled passive house, how does total backup consumption depend on the choice of peak load blackout periods. (2) What comfort penalties arise from properly coping with a variety of peak load blackout periods. (3) Where should off peak energy be introduced into the house. (4) What are the effects of imprecise information on short term future weather.

21925 **Prediction of direct gain solar heating system performance.** Monsen, W.A.; Klein, S.A. (Univ. of Wisconsin, Madison). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 865-869(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

General design methods for building-integrated (passive) solar heating systems are needed to evaluate the effects of design parameters on building energy needs. For collector-storage walls, the Resistance Network Method and the Solar Load Ratio Method are available. For direct gain systems, however, the Solar Load Ratio Method is limited in the scope of system parameters which can be considered; it does not allow the examination of the effects of house capacitance, allowable room temperature swing, or alternative high and low room thermostat set point temperatures. A more general design method for direct gain systems is presented.

21926 **F-Chart/SLR: an interactive program for determining the performance of active and passive solar buildings.** Sullivan, P. (Total Environmental Action, Inc., Harrisville, NH); Wright, W. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 875-878(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Methods for determining the performance of active and passive buildings have been developed by the University of Wisconsin-Madison, Solar Energy Laboratory and the Los Alamos Scientific Laboratory, respectively. The University of Wisconsin work, FCHART, is documented in Solar Heating Design by the F-chart Method, and in an interactive computer program available from the University. Los Alamos' work, the Solar Load Ratio (SLR) method, is documented in a number of individual papers as well as in the Passive Design Handbook. The SLR method is at present primarily a hand calculational procedure although the main features of the program have previously been incorporated in a hand-held programmable calculator program, PASCALC. An overview of a Northeast Solar Energy Center/Total Environmental Action, Inc. computer program which combines the detailed calculational procedures of the SLR method with the interactive features of the FCHART program is presented.

21927 **Prediction of the performance of passive heating systems using the base-temperature method of performance prediction.** Lunde, P.J. (Hartford Graduate Center, CT). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 879-883(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Simplified simulations were made of a spatially isothermal passive wall to provide a data base for adaptation of the base-temperature technique for performance prediction to passive systems. By accounting for night losses from the wall, the technique was simply and easily adapted. Exercise of the model showed that night insulation is a virtual necessity in the Northeast, and that passive performance is much more sensitive to data bases and elevation techniques than are active systems. It was concluded that US radiation data monitoring programs will not produce an adequate data base for design of passive systems.

21928 **Graphic passive design tools for annual performance in the Northeast.** Wright, W.A. (Northeast Solar Energy Center, Boston, MA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 884-888(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Design charts which allow estimation of annual performance of passive space heating systems are described. The charts are derived from parametric variation around a base case using the solar savings fraction algorithm developed at Los Alamos Scientific Laboratories. The charts allow correction of annual performance for variations in building loss coefficient, aperture area, balance point temperature, night insulation R value, and slope and azimuth of the aperture. A graphic method for calculating annual building loads including effects of internal gains, day-night temperatures and solar system type is also presented. An example is worked for water wall with night insulation in the Northeast.

21929 **Computer modeling of thermal storage walls.** Connolly, J.M.; Bingham, C.E.; Ortega, J.K.E. (Solar Energy Research Inst., Golden, CO). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 918-922(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The modeling of the three-dimensional heat transfer characteristics of thermal storage walls and the effect of nonuniform irradiation is investigated. Depending on how much of the wall is irradiated, a small error in energy storage is introduced with the one-dimensional, uniform irradiation assumption. The results show that these assumptions, currentiy used in most passive design codes, are adequate to predict the thermal energy storage characteristics. However, the temperature distribution along the surface of the wall

is much different when the uniform irradiation case is considered. The addition of a highly conductive metal cover on the front surface of the wall does not significantly improve the thermal energy storage characteristics of the wall when the wall is partially irradiated. A selective radiation coating reduces front losses and improves the energy storage capacity of the wall 9 to 13%.

**21930 Validation of heat transfer coefficients for passive cooling.** Loxsom, F.M.; Messer, C.; Doderer, E.; Cripe, A.; Allen, C.P. (Trinity Univ., San Antonio, TX). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 947-951(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Experiments with 12 $ft^2$ water bags with wet and dry surfaces demonstrate that simple turbulent flow equations (e.g., h/sub c/ = C k/L $Re^0$ $^8Pr^0$ $^{33}$) describe convective and evaporative processes involved in the passive cooling of buildings. A passive test facility for humid climates is being built at Trinity University to test passive cooling and heating systems. Acquired data will be used to develop and validate design tools.

**21931 Technical and financial aspects of electric utility peak load reduction through solar space heating system controls.** Crane, R.E.; Lorsch, H.G.; Oswald, R.L. (Franklin Research Center, Philadelphia, PA). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1220-1224(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The use of electrical energy to back up solar space heating systems puts undesirable peak demands on electric utilities. Novel control systems were conceptualized that prevent on-peak electrical power use except for fan and/or pump power. These systems put electrical off-peak energy in storage for later use. Installation costs, hour-by-hour performance, and peak backup demands of these systems and of comparison conventional systems were calculated. Electric utility data were then obtained on the annual cost of providing service to houses equipped with these systems. For Philadelphia, the conventional electric heat pump is the system with the lowest annual cost, closely followed by a conventional system. For utilities with wider generation mixes than the Philadelphia Electric Company, off-peak storage systems will produce lower costs.

**21932 Regional and community impacts of the Department of Energy. Energy technology pilot program in the western Pacific.** Case, C.W. (Univ. of California, Berkeley). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1309-1313(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The Department of Energy (DOE) distributes small grants for alternative energy projects through its Appropriate Energy Technology (AET) Grants Program. This program extends to the western Pacific, where DOE has given 15 grants for projects in American Samoa, the Commonwealth of the Northern Marianas (CMI), Guam, and the Trust Territory of the Pacific. Average grant size is $12.5K. Projects in Guam and the CMI include two solar systems for hot water heating, a typhoon-proof greenhouse, and a methane digester in Guam, and three educational projects for solar water heating and distilling, wind water pumping, and methane generating in the CMI. Some of the projects are successful but others are having difficulties because of particular regional engineering problems (corrosion, typhoons, construction logistics, materials, lack of technicians). Historically, Federal grants are not always in harmony with western Pacific cultures, and AET grants should be distributed with a sensitivity toward long range effects.

**21933 Status and prospects of local solar heating and cooling systems.** Puri, V.M. (Kuwait Inst for Sci Res). *Energy (Oxford) ;* **4**: No. 5, 769-774(Oct 1979). (CONF-790114—).

From Conference on energy alternatives; Honolulu, HI, USA (9 Jan 1979).

A state-of-the-art of solar heating and cooling systems is presented. Solar air heaters and different types of solar water collectors are discussed in detail. storage systems including water, rocks, and heat-of-fusion salts are described as are space heating systems employing solar air heaters, in conjunction with rock or heat-of-fusion salt storage, and the use of water collectors plus hot water storage for space heating and domestic hot water. An indication of the commercialization of various space-heating systems and broad economic projections are presented. The three major solar cooling methods--absorption cooling, solar mechanical systems, and those involving humidification-dehumidification cycles--are also discussed in detail. Finally, an overview of solar heating and cooling activities in Kuwait is also given.

**21934 Solar energy management system.** Moen, R.L. (Honeywell, Inc, Minneapolis, Minn). *Proceedings of the IEEE Conference on Decision and Control ;* **2**: 917-919(1979). (CONF-791222—).

From 18. IEEE conference on decision and control; Fort Lauderdale, FL, USA (12 Dec 1979).

The contractual objective of the Solar Energy Management System (SEMS) was to develop an alternative to the typical residential solar system controller--a controller that is simply a collection of differential thermostats and logic relays. The controller is a microprocessor-based system that capitalizes on the extensive logic and computational capability of today's microprocessor technology to provide a general-purpose, flexible solar energy management system.

**21935 (SOLAR/1044—80/50) Solar project description for Matt Cannon multi-unit apartment, Gainesville, Florida.** Moore, D. (Boeing Co., Seattle, WA (USA)). [nd]. Contract AB01-76CS31020. 56p. NTIS, PC A04/MF A01.

The Matt Cannon site (H-8086) is a four-unit apartment house in Gainesville, Florida. The building has approximately 2420 square feet of conditioned space. Solar energy is used for space heating and preheating domestic hot water (DHW). The solar energy system has an array of flat-plate collectors with a gross area of 597 square feet. The array faces south at an angle of 34 degrees to the horizontal. Water is the transfer medium that delivers solar energy from the collector array to storage. Solar energy is stored above ground in a 1000-gallon steel tank with 4 inches of insulation. Solar-heated water is pumped from storage through an air heat exchanger in the return air-duct of each apartment to satisfy the heating demand. Freeze protection is by drain down. City water is preheated by a heat-exchanger jacket on a 120-gallon preheat tank which supplies preheated DHW, on demand, to a conventional 30-gallon DHW tank in each of the four apartments. When solar energy is insufficient to satisfy the DHW load, an electrical heating element in each DHW tank provides auxiliary energy for water heating. Similarly, an electrical heating element in each apartment air-handler provides auxiliary energy for space heating. The dwelling has been fully instrumented for performance evaluation since January 1978 and the data is integrated into the National Solar Data Network. Original cost estimates for provisioning and installation of the solar system are given.

## 1410 Solar Collectors And Concentrators

*REFER ALSO TO CITATION(S) 21826, 21827, 21839*

**21936 (ANL/EES-TM—135) Atmospheric corrosion of batten and enclosure materials for flat-plate solar collectors.** (ECA, Inc., Woodridge, IL (USA)). Sep 1980. Contract W-31-109-ENG-38. 38p. NTIS, PC A03/MF A01.

As part of the Solar Reliability and Materials Program at Argonne National Laboratory, the atmospheric-corrosion-monitoring project is to assess the materials used for battens and enclosures for flat-plate solar collectors. Sensors at nine test sites have provided atmospheric data. Other data have been obtained by analyzing corrosion samples that were exposed for varying periods of time. This interim report summarizes the results of the first test period.

**21937 (DOE/CS/30133—T1(Vol.1)) Low-cost evacuated-tube solar collector. Final report.** (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 10 Feb 1981. Contract AC04-78CS30133. 262p. NTIS, PC A12/MF A01.

A prototype design for an evacuated tube air cooled solar collector module has been completed. A product cost study, based

on the production of 60,000 of the prototype modules per year (~ 1,000,000 square feet annually), estimates that the module as shipped would have a cost at inventory of $7.09 to $7.40 per square foot of aperture. Computer programs were developed to predict the optical and thermal performance of the module. Antireflective coatings (porous aluminum oxide) which could be formed by spraying or dipping were demonstrated but degraded more rapidly when exposed to a high humidity ambient than acid etched films. A selective black chromium oxide multi-layered graded film was vapor deposited which had an absorptivity of about 0.9 and an emissivity of 0.03. When the film was heated to temperatures of 400°C in a gettered vacuum for as little as 24 hours, however, irreversible changes took place both between and within coating layers which resulted in $\alpha$ decreasing to about 0.73 and $\epsilon$ increasing to 0.14. The product cost studies indicate that module design changes are warranted to reduce product cost prior to tooling for production.

21938 **(DOE/CS/30133—T1(Vol.2)) Low-cost evacuated-tube solar collector appendices. Final report.** Beecher, D.T. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 31 May 1980. Contract AC04-78CS30133. 392p. NTIS, PC A17/MF A01.

A low cost solar heat energy collector module and array has been designed using the evacuated tube, selective absorber, air cooled concept. Glass tubing as used in fluorescent lamps with automatic sealing methods is a key feature of the evacuated tube design. A molded fiber glass concentrating reflector panel and sheet metal header assembly are proposed. Major design problems involved included the cost of materials and labor, thermal expansion and distortion problems, high stagnation and operating temperatures, isolation, thermal efficiency, sealing, joining, air pressure drop, and weight of the preassembled module. A cost of less than $5 per active square foot of collecting surface has been estimated for materials and labor of the module and its mounting frame.

21939 **(DOE/CS/35349—T1) Solar-collector studies for solar-heating and -cooling applications. Final report.** (Inter-Technology/Solar Corp., Warrenton, VA (USA)). 1979. Contract AC04-78CS35349. 165p. NTIS, PC A08/MF A01.

Mirror and lens solar concentrator collectors suitable for space heating, cooling, and hot water applications were surveyed. The scope of the survey includes identification, analysis and comparison for all concentrating collector types for which prototypes and/or market models are or have been built for less than 10X concentration. The survey includes greater than 10X concentration ratios for manufacturers marketing such collectors for space heating and/or cooling applications. Collectors in the conceptual stage are noted and their attributes and disadvantages identified.

21940 **(DOE/ET/20279—137) Liquid photovoltaic/thermal collectors for residential applications.** Hendrie, S.D.; Raghuraman, P.; Cox, C.H. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1981. Contract AC02-76ET20279. 4p. (CONF-810526—22). NTIS, PC A02/MF A01.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

A second-generation, liquid photovoltaic/thermal collector has been designed and is currently under fabrication. Results of computer simulations indicate that the collector unit, which incorporates novel cell and framing concepts, yields significnatly improved performance results over earlier units tested. Predicted performance values of 55% thermal efficiency and 11% electrical efficiency make the performance and this collector competitive with its single-function solar thermal and photovoltaic counterparts.

21941 **(DOE/ET/21109—T1) Tracking instrument and control for solar concentrators. Final technical report, October 1979-January 1981.** Gray, J.; Kuhlman, J. (G K Systems, Inc., Westlake Village, CA (USA)). 31 Jan 1981. Contract AC01-79ET21109. 176p. NTIS, PC A09/MF A01.

The tracker uses a single photo sensor, and a rotating aperature to obtain tracking accuracies better than 1.5 mrads (0.1 degs). Peak signal detection is used to eliminate tracking of false sources, i.e., clouds, etc. A prism is employed to obtain an extended field of view (150 degs axially - 360 degs radially). The tracker digitally measures the Suns displacement angle relative to the concentrator axis, and repositions it incrementally. This arrangement permits the use of low cost non-servo motors. The local controller contains microprocessor based electronics, incorporating digital signal processing. A single controller may be time shared by a maximum of sixteen trackers, providing a high performance, cost effective solar tracking system, suitable for both line and point focus concentrators. An installation may have the local controller programmed as a standalone unit or slaved to a central controller. When used with a central controller, dynamic data monitoring and logging is available, together with the ability to change system modes and parameters, as desired.

21942 (LA—8797-PR, pp 21-23) **Active solar systems technology.** Apr 1981. NTIS, PC A05/MF A01.

In Energy technology. Progress report, October-December 1980.

Active Solar Systems Technology reports the initiation of an investigation of corrosion in liquid-cooled systems. Numerical modeling to investigate various methods for solar drying of sewage sludge is being conducted and is reported.

21943 (LA—8797-PR, pp 25-31) **Solar ponds.** Apr 1981. NTIS, PC A05/MF A01.

In Energy technology. Progress report, October-December 1980.

The Solar Ponds program reports the results of a survey of oceanographic literature. Transport rules for oceanographic thermohaline systems are felt to be applicable to solar ponds. As a result, the existence of a boundary layer at the interface between the convecting and nonconvecting regions of a solar pond is postulated. Numerical analysis indicates that the convecting region will encroach upon the nonconvecting region when the temperature regions across the nonconvecting region exceed a critical value.

21944 **(NBS-TN—1134) Guidelines for the installation of solar components on low-sloped roofs.** Mathey, R.G.; Rossiter, W.J. Jr. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Nov 1980. Contract AI01-76PR06010. 82p. NTIS, PC A05/MF A01.

Guidelines were prepared for the installation of solar collectors and related equipment on low-sloped roofs of commercial and industrial type buildings. The guidelines are concerned primarily with the waterproofing integrity of the roofing system, access to the collectors and roofing, attachment of different types of collector support frames and safety. Technical information from the literature, building codes, roofing field surveys and acceptable roofing practice provided the basis for the guidelines. The guidelines include recommendations for the design of the solar installation with regard to roofing performance, workmanship during collector installation and maintenance of roofs with solar components. A field survey was conducted to inspect the condition of low-sloped built-up roofing systems which were retrofitted with solar collector systems. Literature and field surveys were conducted to identify roofing problems attributed to solar equipment installation on roofs and the effect of the installation on roofing performance. The results of the literature and field surveys are presented. Applicable building codes and related documents were examined to obtain information concerning the effect of the installation of solar components on rooftop safety.

21945 **(SAND—80-1583) Analytical studies of a parabolic line concentrator utilizing an aluminum honeycomb support structure and a thin glass reflector laminate.** Koteras, J.R. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 84p. NTIS, PC A05/MF A01.

Results (stresses, displacements, and equivalent slope errors) are presented from finite element analyses made to evaluate a design for a parabolic trough solar concentrator. The concentrator consists of a reflector laminate (made of thin glass bonded to sheet metal backing) which is mechanically formed and bonded to a stiff parabolic support (made of aluminum honeycomb bonded to steel skins) with a 2 meter (6.6 foot) aperture. Analyses were first made to determine a length for the concentrator such that it would meet certain performance and survivability criteria under wind and grav-

ity loadings. These studies were made with a model for the concentrator only. The concentrator model was then combined with a model for a support mechanism, and this combined structure was studied for several wind and gravity loadings. A design characterized by a six meter (twenty foot) long concentrator was found to meet performance criteria and had sufficiently low glass stresses in a 40.23 meter per second ((ninety mile per hour) wind.

21946 **(SAND—81-0290) Initial experience and preliminary results: solar collector materials exposure to the IPH site environment.** Randall, D.E.; Morris, V.L. (Sandia National Labs., Albuquerque, NM (USA); McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Mar 1981. Contract AC04-76DP00789. 192p. NTIS, PC A08/MF A01.

A test program to evaluate the influence of the industrial plant site environment upon the performance characteristics of solar collector reflector and receiver materials is being conducted at Industrial Process Heat solar project sites. This program has demonstrated that the industrial environment offers a variety of sources that can affect the optical characteristics of reflectors and receivers through the mechanisms of soiling and corrosion. Preliminary test results are presented herein.

21947 **(SAND—81-0313) Experimental parabolic trough collector performance characterization.** Lukens, L.L. (Sandia National Labs., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 20p. NTIS, PC A02/MF A01.

Experimental data from the Collector Module Test Facility (CMTF) at Sandia National Laboratories, Albuquerque, are used to develop a collector performance model and characterize three parabolic trough solar collectors. The independent variables used in the model are selected and fitted to the experimental data using a multiple linear regression technique. The collector model developed accounts for optical performance, including incident angle effects and thermal losses, both linear and non-linear.

21948 **(SAND—81-0385) Cleaning strategies for parabolic-trough solar-collector fields; guidelines for decisions.** Bergeron, K.D.; Freese, J.M. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1981. Contract AC04-76DP00789. 54p. NTIS, PC A04/MF A01.

This report is intended to assist the owner or operator of a parabolic trough solar collector system to decide on a cleaning strategy (equipment, materials, procedures, and schedules). The guidelines are based on information obtained in past research studies, as well as interviews with vendors and users of cleaning and water treatment equipment. The basic procedure recommended utilizes high pressure portable washing equipment. However, since the cleaning problem is so site-specific, no single, detailed approach can be specified. A systematic procedure for evaluating the particular requirements of a site is therefore given. This will allow the solar energy system operator to develop a cleaning strategy which is cost-effective because it is suited to local conditions.

21949 **(SERI/TR—731-587) Solar ponds.** Jayadev, T.S.; Edesess, M. (Solar Energy Research Inst., Golden, CO (USA)). Apr 1980. Contract AC02-77CH00178. 40p. NTIS, PC A03/MF A01.

This report first describes the different types of solar ponds including the nonconvecting salt gradient pond and various saltless pond designs. It then discusses the availability and cost of salts for salt gradient ponds, and compares the economics of salty and saltless ponds as a function of salt cost. A simple computational model is developed to approximate solar pond performance. This model is later used to size solar ponds for district heating and industrial process heat applications. For district heating, ponds are sized to provide space conditioning for a group of homes, in different regions of the United States. Size requirements is on the order of one acre for a group of 25 to 50 homes. An economic analysis is performed of solar ponds used in two industrial process heat applications. The analysis finds that solar ponds are competitive when conventional heat sources are priced at $5 per million Btu and expected to rise in price at a rate of 10% per year. The application of solar ponds to the generation of electricity is also discussed. Total solar pond potential for displacing conventional energy sources is estimated in the range of from one to six quadrillion Btu per year in the near and intermediate future.

21950 **Geometrical vector flux sinks and ideal flux concentrators.** Greenman, P. (The University of Chicago, Enrico Fermi Institute, Chicago, Illinois 60637). DE-AC02-80ER-10575. *Journal of the Optical Society of America ;* **71**: No. 6, 777-779(Jun 1981).

The description of ideal flux concentrators as shapes that do not disturb the geometrical vector flux field is extended to all the known types of ideal flux concentrators. This is accomplished, in part, by the introduction of vector flux sinks.

21951 **Focusing solar air heater with rock storage.** Parker, B.F.; White, G.M.; Loewer, O.J. (Univ. of Kentucky, Lexington). pp 110-113 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineers (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

The approach used an air heating focusing collector with heat storage in crushed rock for several days before drying a batch of grain. The collector and some concepts of heat storage in crushed rock are explained. A focusing solar air heater consisting of a parabolic trough reflector and a unique linear receiver were constructed and tested. The receiver consists of 24 5-mil aluminum fins spaced 15° apart in a 10-cm glass pipe so that solar rays focused on a line have multiple reflections between the fins for maximum absorption. The fins also provide a large absorber surface area for transferring heat to the air. The collector test results are presented in a modified form of the Hottel-Whillier-Bliss equation. Two airflow rates were tested with input temperatures ranging from 15 to 100°C (59 to 212°F) and output temperatures from 70 to 210°C (158 to 410°F). The efficiency for heating ambient air (probably the major use of this collector) was 49 to 57% of the direct beam solar radiation. Heat exchange between crushed rock and air and the pressure drop due to flow through crushed rock were studied analytically and experimentally. The rate of heat exchange is greatly improved with small stone as compared to large stone.

21952 **Toward efficiency at the interface: spectrally selective surfaces for photothermal conversion.** Jacobson, M.R. (Univ. of Arizona, Tucson). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 971-980(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Spectrally selective surfaces are a critically important and particularly elegant element of photothermal energy conversion systems. A very thin coating, consisting of one or more carefully specified and fabricated layers, can profoundly improve the performance of an entire system by acting as a one-way valve for radiant energy. Unlike most thin film systems, successful selective surfaces must not only possess specific optical properties, but also operate in difficult environments. This review begins by setting basic criteria for practical selective surfaces and continues with a discussion of the physical phenomena underlying selectivity. A number of selective coatings are then described in some detail, including absorber-reflector tandems, evaporated cermets, black chrome, and interference multilayers. A sketch of the scientific context within which selective surfaces have developed is given.

## 1420 Heat Storage

*REFER ALSO TO CITATION(S) 21931, 21951*

21953 **Longterm storage of coolness.** Borst, W.L.; Aghamir, F. (Southern Illinois Univ., Carbondale). Contract FG02-79RS10106. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 908-912(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The feasibility of longterm storage of ambient coolness was studied early 1980 by using a water mass of 34,700 kg (9165 gals) in an underground cistern. Coolness was collected with a solar collector at night (covers removed) or by blowing cold ambient air over

the water in the energy storage cistern. The latter method of cooling proved to be much more effective as far as necessary equipment and parasitic use of electric power were concerned. The existing cistern (no longer needed for potable water storage) was retrofitted with 0.15 m (6 in.) urethane insulation on its inner surface. An average energy storage time constant was determined experimentally and found to be about 8 months. A single 1/e time constant for temperature decay was not well defined because of surrounding soil temperatures that vary with depth and season. However, it can be said that the storage of coolness (and heat) with the present system seems possible for periods of 1/2 year thus optimizing the collection and storage of coolness in winter (and solar heat in summer).

# 15 GEOTHERMAL ENERGY

*REFER ALSO TO CITATION(S) 22166*

21954 **(SAND—81-0662) Geothermal technology publications and related reports: a bibliography, January 1977-December 1980.** Hudson, S.R. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 120p. NTIS, PC A06/MF A01.

This bibliograhy lists titles, authors, abstracts, and reference information for publications which have been published in the areas of drilling technology, logging instrumentation, and magma energy during the period 1977-1980. These publications are the results of work carried on at Sandia National Laboratories and their subcontractors. Some work was also done in conjunction with the Morgantown, Bartlesville, and Pittsburgh Energy Technology Centers.

## 1501 Resource Status And Assessment

21955 **(DOE/RA/50076—T3) Evaluation of geothermal energy in Arizona. Arizona geothermal planning/commercialization team. Quarterly topical progress report, July 1-September 30, 1980.** White, D.H.; Mancini, F.; Goldstone, L.A.; Malysa, L. (Arizona Solar Energy Research Commission, Phoenix (USA)). 1980. Contract FC03-80RA50076. 154p. NTIS, PC A08/MF A01.

Progress is reviewed on the following: area development plans, evaluation of geothermal applications, continued evaluation of geothermal resources, engineering and economic analyses, technical assistance in the state of Arizona, the impact of various growth patterns upon geothermal energy development, and the outreach program. (MHR)

21956 **(LA—8801-MS) Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate.** Aldrich, M.J.; Laughlin, A.W.; Gambill, D.T. (Los Alamos Scientific Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 60p. NTIS, PC A04/MF A01.

Review of the Electric Power Research Institute's (EPRI) method for calculating the geothermal resource base of a country shows that modifications are needed for several of the assumptions used in the calculation. These modifications include: (1) separating geothermal belts into volcanic types with a geothermal gradient of 50°C/km and complex types in which 80% of the area has a temperature gradient of 30°C/km and 20% has a gradient of 45°C/km, (2) using the actual mean annual temperature of a country rather than an assumed 15°C average ambient temperature, and (3) making separate calculations for the resource stored in water/brine and that stored in rock. Comparison of this method (Revised EPRI) for calculating a geothermal resource base with other resource base estimates made from a heat flow map of Europe indicates that the technique yields reasonable values. The calculated geothermal resource bases, stored in water and rock to a depth of 5 km, for each country in the world are given. Approximately five times as much energy is stored in rock as is stored in water.

21957 **(USGS-OFR—80-490) Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: an update.** Wassinger, C.E.; Koza, D.M. (Geological Survey, Washington, DC (USA)). 1980. 23p. Geological Survey, Washington, DC.

The geothermal resource potential of the Alvord Valley is among the highest in Oregon. However, environmental concerns, litigation, and administrative requirements have delayed exploration for and development of this resource. Present estimates indicate that deep exploratory drilling may not take place on Federal lands in the Alvord Valley until 1982.

## 1502 Geology And Hydrology Of Geothermal Systems

21958 **(DOE/ET/27111—2) Using presence of calcite cap rock in shales to predict occurrence of reservoirs composed of leached secondary porosity in the geopressured zone. Annual report, June 1, 1980-October 31, 1980.** Kaiser, W.R.; Magara, K.; Milliken, K.L.; Richmann, D.L. (Texas Univ., Austin (USA). Bureau of Economic Geology). Jan 1981. Contract AC08-79ET27111. 36p. NTIS, PC A03/MF A01.

The distribution of high-resistivity shale in the Frio Formation between hydropressured and geopressured strata has been mapped along the Texas Gulf Coast. Two high-resistivity intervals more than 1000 ft thick have been mapped, one in Brazoria and Galveston Counties and the other in Kenedy County. They coincide with Frio delta systems and may be related to extraordinary quantities of $CO_2$ produced by deltaic sediments rich in woody and herbaceous matter. Beyond being calcareous, the nature of the high-resistivity interval is enigmatic and its relationship to deep secondary porosity problematic. Most of the contained carbonate is microscopically and isotopically skeletal in origin, revealing no evidence of diagenetic modification. Minor rhombs of iron-bearing carbonate tens of microns in size were identified. Detrital feldspar compositions are being established to test subsequent changes in feldspar composition resulting from progressive burial and albitization. Hydrolysis reactions for authigenic minerals and reactions between key pairs of minerals have been written. Thermodynamic functions for complex phyllosilicates at temperatures up to 200°C have been calculated. From thermodynamic calculations it was predicted that ferroan calcite would be the favored authigenic carbonate in shales.

21959 **(DOE/ET/28388—T1) Structure of the Presidio Bolson area, Texas, interpreted from gravity data.** Mraz, J.R.; Keller, G.R. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1980. Contract AS05-76ET28388. 23p. NTIS, PC A02/MF A01.

To obtain a better understanding of the structure and tectonism of the region, an integrated geophysical-geological study of the Presidio area, Texas, was undertaken using gravity measurements and deep drilling data. New gravity data were combined with existing data to construct simple Bouguer anomaly maps of the Presidio area, and two-dimensional computer modeling of gravity profiles was used to derive earth models. These data outline the major geologic features of the area that are dominated by the effects of Tertiary block faulting and volcanism. The main feature of interest was the Presidio Graben, which is approximately 1.5 km deep near Ruidosa, Texas. One motivation for this study was the collection of a part of the basic scientific data needed to assess the geothermal potential of the area, and the results obtained support the hypothesis that hot springs associated with the Presidio Graben derive their heat from deep circulation along its boundary faults. However, some gravity anomalies observed could be interpreted as indicating the presence of late Tertiary intrusions that could provide heat for the hot springs.

21960 **(LBL—12174) Performance matching and prediction for Serrazzano geothermal reservoir by means of numerical simulation.** Pruess, K.; Weres, O. (Lawrence Berkeley Lab., CA (USA)). Oct 1980. Contract W-7405-ENG-48. 51p. (CONF-801098—2). NTIS, PC A04/MF A01.

From 2. DOE-ENEL workshop for cooperative research in geothermal energy; Berkeley, CA, USA (20 Oct 1980).

The simulator SHAFT79 of Lawrence Berkeley Laboratory has been applied to field-wide distributed parameter simulation of the vapor-dominated geothermal reservoir at Serrazzano, Italy. Using a three-dimensional geologically accurate mesh and detailed flow rate data from 19 producing wells, a period of 15.5 years (from 1959 to 1975) has been simulated. The reservoir model used is based on field measurements of temperatures and pressures, labo-

ratory data for core samples, and available geological and hydrological information. The main parameters determined (adjusted) during development of the simulation are permeabilities and much of the initial conditions.

## 1503 Geothermal Exploration And Exploration Technology

*REFER ALSO TO CITATION(S) 21959*

**21961 (LA-UR—81-1092) Acoustic radiation patterns for borehole sources.** Fehler, M.; Pearson, C.F. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 20p. (CONF-810379—1). NTIS, PC A02/MF A01.

From Society of Well Log Analyst's annual meeting; Mexico City, Mexico (20 Mar 1981).

Amplitudes of S and P waves from commercial borehole acoustic logging tools depend on the angle between the borehole axis and the direction of propagation as well as the distance between source and receiver. Knowledge of the angular dependence or radiation pattern, is necessary to properly measure the attenuation of waves traveling between two boreholes. Functional expressions are shown for the S and P-waves amplitudes. Experimental work in relatively homogeneous granite suggests that this relationship adequately describes the radiation pattern for both explosive sources and for acoustic transducers placed in fluid filled boreholes. Using these functional expressions for the S and P-wave amplitudes a technique was developed to estimate Q, the quality factor, and locate discrete fractures in crystalline rock that compose the Hot Dry Rock Geothermal Reservoir at Fenton Hill, New Mexico.

**21962 (USGS-OFR—79-1248) Preliminary geological interpretation and lithologic log of the exploratory geothermal test well (INEL-1), Idaho National Enginering Laboratory, eastern Snake River Plain, Idaho.** Doherty, D.J.; McBroome, L.A.; Kuntz, M.A. (Geological Survey, Washington, DC (USA)). 1979. 10p. Geological Survey, Washington, DC.

A 10,365 ft (3159 m) geothermal test well was drilled in the spring of 1979 at the Idaho National Engineering Laboratory, eastern Snake River Plain, Idaho. The majority of rock types encountered in the borehole are of volcanic origin. An upper section above 2445 ft (745 m) consists of basaltic lava flows and interbedded sediments of alluvial, lacustrine, and volcanic origin. A lower section below 2445 ft (745 m) consists exclusively of rhyolitic welded ash-flow tuffs, air-fall ash deposits, nonwelded ash-flow tuffs, and volaniclastic sediments. The lithology and thickness of the rhyolitic rocks suggest that they are part of an intracaldera fill.

**21963 (USGS-OFR—79-1307) Audio-magnetotelluric data log and station-location map for the Silver Star Hot Springs area, Montana.** Long, C.L.; Senterfit, R.M. (Geological Survey, Washington, DC (USA)). 1979. 9p. Geological Survey, Washington, DC.

During a period of 3 days, 22 audiomagnetotelluric (AMT) soundings were made in the area of the Silver Star Hot Springs, Montana. These surroundings were made to assess the geothermal potential along a northern trend of hot springs from New Biltmore Hot Springs north to Broadwater Hot Springs, Montana. Scalar resistivities from the data log show that thermal waters have probably altered the Cenozoic basin fill to the northeast for at least 4 to 5 km. Leakage of the geothermal system to the surface is probably taking place along a range-front fault at the contacts between the Precambrian metamorphics on the west and the Cenozoic basin fill on the east. Any potential geothermal system would probably be in the area near the existing hot springs or within a few kilometers to the north or northeast.

**21964 (USGS-OFR—79-1467) Heat flow in relation to hydrothermal activity in the southern Black Rock Desert, Nevada.** Sass, J.H.; Zoback, M.L.; Galanis, S.P. Jr. (Geological Survey, Washington, DC (USA)). 1979. 42p. Geological Survey, Washington, DC.

As part of an investigation of the Gerlach NE KGRA (Known Geothermal Resource Area) a number of heat-flow measurements were made in playa sediments of the southern Black Rock Desert, northwestern Nevada. These data together with additional previously unpublished heat-flow values reveal a complex pattern of heat flow with values ranging between 1.0 to 5.0 HFU (40 to 100 $mWm^{-2}$) outside of the hot springs area. The mean heat flow for the 13 reported sites in the southern Black Rock Desert is 1.8 +- 0.15 HFU (75 +- 6 $mWm^{-2}$). The complexity of the pattern of heat flow is believed to arise from hydrothermal circulation supporting the numerous hot springs throughout the region. The fact that the lowest observed heat flow occurs in the deepest part of the basin strongly suggests that fluid movement within the basin represents part of the recharge for the hydrothermal system. A thermal balance for the system incorporating both anomalous conductive heat loss and convective heat loss from the spring systems indicate a total energy loss of about 8.0 Mcal/sec or 34 megawatts over an estimated 1000 $km^2$ region. Consideration of this additional heat loss yields a mean regional heat flow of 2.5 + HFU (100 + $mWm^{-2}$) and warrants inclusion of this region in the Battle Mountain heat-flow high (Lachenbruch and Sass, 1977, 1978).

## 1504 Legal And Institutional Aspects

*REFER ALSO TO CITATION(S) 21957*

**21965 (DOE/ET/27163—2) Baca Geothermal Demonstration project legal and regulatory challenges. First semiannual report for period through June 30, 1980.** Province, S.G.; Walter, K.M.; Miller, J. (WESTEC Services, Inc., Albuquerque, NM (USA)). Dec 1980. Contract FC03-78ET27163. 54p. NTIS, PC A04/MF A01.

The Legal and Regulatory Constraints Reports identify and describe the major legal and institutional constraints associated with the Baca Geothermal Demonstration Project. The impacts of these constraints on the Project in terms of cost, schedule, and technical design are also analyzed. The purpose of these reports is to provide a guide for future geothermal development.

## 1505 Economic And Financial Aspects

**21966 (DOE/ET/27087—T1) Operations research and systems analysis of geopressured/geothermal resources in Texas. Final report.** Lesso, W.G.; Zinn, C.D.; Cornwell, J. (Texas Univ., Austin (USA). Center for Energy Studies). May 1981. Contract AS08-78ET27087. 123p. NTIS, PC A06/MF A01.

A preliminary resource assessment, based on the best available parameters, was made to identify potentially suitable fairways. Of those examined only the Brazoria Fairway in the Frio Formation was able to produce sufficient fluid to meet the minimum requirements. These requirements are based upon the need for a well to produce an initial flow rate of 40,000 bbl/day with a 6% decline rate over a 30 year production period. Next, a development planning analysis was done to determine the number of wells that would have to be drilled in the fairway, considering the probability of success, and the number of drilling rigs available. The results of this analysis provided a time phased scenario and costs of developing the fairway. These were next used in an economic analysis. The economic analysis was performed to determine the present worth of using the resource under a range of values for the key economic parameters. The results of this study indicate that the commercial development of geopressured, geothermal resource is highly dependent upon the pricing of natural gas in the US, the development of tax incentives to spur development, and a better understanding of the nature of the resource through additional well tests.

**21967 (LBL—11940) Identification of geothermal reserves and estimation of their value.** Howard, J.H. (Lawrence Berkeley Lab., CA (USA)). Dec 1980. Contract W-7405-ENG-48. 12p. (CONF-801233—9). NTIS, PC A02/MF A01.

From 6. annual workshop on geothermal reservoir engineering; Stanford, CA, USA (16 Dec 1980).

A procedure, is discussed for estimating the value of a hot water geothermal property from a resource owner's point of view. Two methods make up the procedure: a conservative method of es-

timation and an optimistic one. Value of a property by both methods is estimated to equal the present value of future income less the cost of resource extraction. The two methods share a common set of assumptions (e.g., that the price of hot water at the start of cash flow from a project will be the same). However, the methods differ in important ways. The optimistic method, for example, allows for future increase in price that in turn offsets discounting of future income. Together the methods define a range of values that might reasonably be assigned to a property.

## 1506 Environmental Aspects And Waste Disposal

*REFER ALSO TO CITATION(S) 21957*

**21968 (LBL—12175) Reinjection studies of vapor-dominated systems.** Schroeder, R.C.; O'Sullivan, M.J.; Pruess, K.; Celati, R.; Ruffilli, C. (Lawrence Berkeley Lab., CA (USA)). Oct 1980. Contract W-7405-ENG-48. 74p. (CONF-801098—3). NTIS, PC A04/MF A01.

From 2. DOE-ENEL workshop for cooperative research in geothermal energy; Berkeley, CA, USA (20 Oct 1980).

The basic physical phenomena associated with geothermal injection are reviewed; problems associated with its numerical simulation are discussed; and the results of some numerical studies are presented. The particular problems chosen for study are: injection of cold water into a thin (single layer) reservoir; a five-spot production/injection configuration in a thin (single layer) reservoir; injection of cold water into a thick (multi-layer) reservoir; and injection of cold water into a one-dimensonal vertical column, representing a cross section of Larderello geothermal reservoir. (MHR)

**21969 (LBL—12392) Problem definition study of subsidence caused by geopressured geothermal resource development.** (EDAW, Inc., Palo Alto, CA (USA); Earth Sciences Associates, Palo Alto, CA (USA)). Dec 1980. Contract W-7405-ENG-48. 196p. (GSRMP—10). NTIS, PC A09/MF A01.

The environmental and socio-economic settings of four environmentally representative Gulf Coast geopressured geothermal fairways were inventoried. Subsidence predictions were prepared using feasible development scenarios for the four representative subsidence sites. Based on the results of the subsidence estimates, an assessment of the associated potential environmental and socioeconomic impacts was prepared. An inventory of mitigation measures was also compiled. Results of the subsidence estimates and impact assessments are presented, as well as conclusions as to what are the major uncertainties, problems, and issues concerning the future study of geopressured geothermal subsidence.

## 1508 Geothermal Power Plants

**21970 (DOE/ET/27163—1) Baca Geothermal Demonstration Project. Quarterly technical progress report, April 1-June 30, 1980.** (WESTEC Services, Inc., Albuquerque, NM (USA)). Dec 1980. Contract FC03-78ET27163. 33p. NTIS, PC A03/MF A01.

Topics covered include progress made in the well and steam production systems, the power plant and transmission systems, and in the project data management program.

## 1509 Geothermal Engineering

*REFER ALSO TO CITATION(S) 21573, 21960*

**21971 (EGG—1183-1797) Pulsating-flow measurement with an orifice flange.** Bossart, L.M. (EG and G, Inc., Las Vegas, NV (USA)). 1981. Contract AC08-76NV01183. 7p. (CONF-810637—1). NTIS, PC A02/MF A01.

From 11. transducer workshop; Seattle, WA, USA (2 Jun 1981).

This paper resulted from a measurement problem encountered during instrumentation of a Geothermal air drilling operation on the Baca Ranch in the Jemez Mountains in New Mexico. The problem was how to measure the flow of ammonia water solution injected into the air line. The flow is pulsating as the pressure in the ammonia line fluctuates above and below the pressure in the air line. The pump that develops the pressure in the ammonia line is not a positive displacement pump, therefore, counting pump strokes does not determine the number of gal/min of ammonia flow. The flow was measured using an orifice flange differential pressure technique but, the range of flow measured, exceeded the 4:1 range ability of an orifice. A computer smoothing of the differential pressure and the line pressure together with a scaling factor, determined by the shape of the raw differential pressure, provided a smoothing of the flow data which was checked against the actual flow over a long time period to determine the volume of solution injected into the system per hour. An instantaneous reading of ammonia flow was thereby determined. It showed small variations in corrosion rate measured in the standpipe that may have been caused by a momentary variation in the flow of ammonia solution.

**21972 (LA-UR—81-1430) When the hole is dry: the HDR alternative in the cascades.** Arney, B.; Brown, D.; Potter, R. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-810572—1). NTIS, PC A02/MF A01.

From Geothermal Resources Council symposium; Portland, OR, USA (19 May 1981).

The Hot Dry Rock (HDR) method of heat extraction was developed by Los Alamos in silicic plutonic-metamorphic rocks of Precambrian age. Now that the method and mechanisms are better understood, other rock types are under consideration as potential HDR reservoirs. High heat flow over much of the Northwest indicates the potential for geothermal power and heat is great if ways to develop it could be found. Currently two conceptual models for HDR development in volcanic rocks are under development. Experiments planned for this summer should indicate how the rocks behave and how this behavior compares to existing models.

**21973 (SAND—81-7066) Program for the improvement of downhole drilling motor bearings and seals. Phase IV. Final report.** Tibbets, G.A.; DeLafosse, P.H.; Black, A.; Green, S.J. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 95p. NTIS, PC A05/MF A01.

Test results are presented from the seal test machine and bearing-seal package. An overal program summary is given and the major milestones of this phase of the program are shown. (MHR)

**21974 Geothermal energy: thermomechanics of heat extraction from hot, dry rock masses.** Nemat-Nasser, S. (Northwest Univ, Evanston, Ill). pp 431-443 of Proceedings of an international conference on fraction mechanics in engineering applications. Germantown, MD; Sijthoff and Noordhoff, Alphen aan den Rijn (1979).

From International conference on fracture mechanics in engineering applications; Bangalore, India (26 Mar 1979).

The process is studied theoretically with a view towards: estimating the heat exchange between the fluid and the surrounding rock; calculating the initial spacing and the growth pattern of secondary thermally induced cracks which develop perpendicular to the face of the primary crack, as the rock is cooled; and examining the steady-state fluid flow and convective heat transfer in the primary crack. It turns out that the nature of the thermally induced secondary cracks has a dominant effect on whether a plant of this kind will become economically viable with a suitably long life of service. The paper summarizes some of the fundamental work on the growth pattern and stability of such a system of cracks, pointing out the likelihood, under stated conditions, that secondary cracks will serve as heat exchangers. 13 refs.

**21975 Forced vibration of a fluid-filled hydraulic fracture.** Hsu, Y.C. (Univ of NM, Albuquerque). pp 457-467 of Proceedings of an international conference on fraction mechanics in engineering applications. Germantown, MD; Sijthoff and Noordhoff, Alphen aan den Rijn (1979).

From International conference on fracture mechanics in engineering applications; Bangalore, India (26 Mar 1979).

The paper considers a vertical penny-shaped fracture (reservoir) which is filled with fluid and subjected to seismic waves and/

or blast-like impulses applied down-hole. It investigates fluid column vibrations of down-hole internal net pressure required to keep the crack open, and of the crack itself. Of particular interest is the derived, closed-form solution of the period, tau, of vibrations which is sensitive to the radius, R, of the penny-shaped crack. Experimental determination of tau in conjunction with the derived closed-form of tau will permit R to be evaluated accurately.

## 1510 Direct Energy Utilization

**21976 (CONF-810471—1) Agriculture, greenhouse, wetland and other beneficial uses of geothermal fluids and heat.** Schmitt, R.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 12p. NTIS, PC A02/MF A01.

From 1. Sino/U.S. geothermal resources conference; Tianjin, China (5 Apr 1981).

The status for related beneficial uses including agriculture, greenhousing, and geothermal wetlands is presented. Data published for the geothermal fluids found in areas of China have been examined and compared with the geothermal fluids used in the agriculture evaluations in the United States. This comparison indicates that the geothermal fluids found in parts of China are similar to those used in the US agriculture experiments. Greenhousing is addressed largely from the standpoint of hardware systems and technology being employed or being proposed in the United States.

**21977 (DOE/ET/27233—T3) Pahoa geothermal industrial park. Engineering and economic analysis for direct applications of geothermal energy in an industrial park at Pahoa, Hawaii.** Moreau, J.W. (Hawaiian Dredging and Construction Co., Honolulu (USA). Advanced Projects Dept.). Dec 1980. Contract AC03-79ET27233. 437p. NTIS, PC A19/MF A01.

This engineering and economic study evaluated the potential for developing a geothermal industrial park in the Puna District near Pahoa on the Island of Hawaii. Direct heat industrial applications were analyzed from a marketing, engineering, economic, environmental, and sociological standpoint to determine the most viable industries for the park. An extensive literature search produced 31 existing processes currently using geothermal heat. An additional list was compiled indicating industrial processes that require heat that could be provided by geothermal energy. From this information, 17 possible processes were selected for consideration. Careful scrutiny and analysis of these 17 processes revealed three that justified detailed economic workups. The three processes chosen for detailed analysis were: an ethanol plant using bagasse and wood as feedstock; a cattle feed mill using sugar cane leaf trash as feedstock; and a papaya processing facility providing both fresh and processed fruit. In addition, a research facility to assess and develop other processes was treated as a concept. Consideration was given to the impediments to development, the engineering process requirements and the governmental support for each process. The study describes the geothermal well site chosen, the pipeline to transmit the hydrothermal fluid, and the infrastructure required for the industrial park. A conceptual development plan for the ethanol plant, the feedmill and the papaya processing facility was prepared. The study concluded that a direct heat industrial park in Pahoa, Hawaii, involves considerable risks.

## 1520 Geothermal Data And Theory

*REFER ALSO TO CITATION(S) 22733*

## 16 Wave Energy Converters

*REFER ALSO TO CITATION(S) 21843*

# 17 WIND ENERGY

**21978 (PNL—3435) Wind measurement systems and wind tunnel evaluation of selected instruments.** Ramsdell, J.V.; Wetzel, J.S. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 79p. NTIS, PC A05/MF A01.

The Pacific Northwest Laboratory has conducted wind tunnel tests of seven relatively inexpensive wind measurement systems as part of a program to evaluate the accuracy and reliability of instruments for use in small wind energy conversion system siting studies. This report discusses wind measurement systems and documents the results of the wind tunnel studies. Documentation consists of graphs and tables relating system and system component performance to wind speed. The results describe instrument system performance under ideal conditions; tests in the atmosphere are required to evaluate performance under realistic conditions.

**21979 Large wind turbines: early operational experience and potential for supplying electricity.** Thomas, R.L.; Robbins, W.H. (Lewis Research Center, Cleveland, OH). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1486-1492(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

The wind resource is such that wind energy generation has the potential to save 6 to 7 quads of energy nationally. Thus, the Federal government is sponsoring and encouraging the development of cost effective and reliable wind turbines. One element of the Federal Wind Energy Programs, Large Horizontal Axis Wind Turbine Development, is managed by the NASA Lewis Research Center for the Department of Energy. There are several ongoing wind system development projects oriented primarily toward utility application within this program element. In addition, a comprehensive technology program supporting the wind turbine development projects is being conducted. This paper presents an overview of the NASA activities with emphasis on application of large wind turbines for generation of electricity by utility systems.

## 1701 Availability (climatology)

*REFER ALSO TO CITATION(S) 21985*

**21980 (HNEI—81-01) Guidebook on wind energy-conversion applications in Hawaii.** (Hawaii Univ., Manoa (USA). Hawaii Natural Energy Inst.). Feb 1981. 80p. Hawaii Natural Energy Institute, Manoa.

The wind energy resource assessment program is gathering data which can be used to site WECS and wind farms; its RD and D projects will help work out problems in applications; its TEAM program will help WECS manufacturers by providing accelerated operating experience for long-term reliability evaluation of equipment; and the wind energy development program will establish the needed state infrastructure, market program, and public information program to resolve other problems that may impede full wind utilization. Hawaii Natural Energy Institute's belief that wind energy can make a significant contribution to Hawaii's energy supply in the very near future and that its Wind Energy Application Network program will help accelerate this contribution are the impetus for this Guidebook on Wind Energy Conversion Applications in Hawaii. Its pages should help those interested in wind energy: it attempts to address all issues which might be involved in decisions to use WECS.

**21981 Federal Wind Energy Program for wind resource assessment and siting: an overview.** Wendell, L.L. (Pacific Northwest Lab., Richland, WA). Contract AC06-76RL01830. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1452-1458(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

In this overview, the technical progress in wind resource assessment and siting is highlighted from the work of the Pacific Northwest Laboratory (PNL) and its subcontractors. One of the major efforts in the program is the completion of the regional wind energy assessments covering the United States and its territories. Also, methods for selecting the specific locations of wind turbines have been developed for both large and small machines.

21982 **Wind characteristics in suthern Wyoming.** Martner, B.E.; Gilkey, K.B.; Marwitz, J.D.; Tobiasen, C. (Univ. of Wyoming, Laramie). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3,2**: 1468-1472(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

A large array of giant wind turbine generators is planned for the Medicine Bow, Wyoming area. Wind measurements in the area from a network of near-surface anemometers and a meteorological tower are presented. Annual mean speeds at 3 m agl are about 6 $ms^{-1}$ and range from about 4 $ms^{-1}$ in summer months to 10 $ms^{-1}$ in winter. Topographic funneling of cold air drainage flow creates the high wintertime speeds. The prevailing wind direction is westerly. The tower data show a sharp increase of speed with height.

## 1706 Wind Energy Engineering

*REFER ALSO TO CITATION(S) 21815, 21837, 21980, 21980, 21981, 21982*

21983 **(DOE/ET/23151—80/1) Review of remote-sensor potential for wind-energy studies.** Hooke, W.H. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.). Mar 1981. Contract AI06-79ET23151. 182p. NTIS, PC A09/MF A01.

This report evaluates a number of remote-sensing systems such as radars, lidars, and acoustic echo sounders which are potential alternatives to the cup- and propeller anemometers routinely used in wind energy siting. The high costs and demanding operational requirements of these sensors currently preclude their use in the early stages of a multi-phase wind energy siting strategy such as that recently articulated by Hiester and Pennell (1981). Instead, these systems can be used most effectively in the lattermost stages of the siting process - what Hiester and Pennell (1981) refer to as the site development phase, necessary only for the siting of large wind-energy conversion systems (WECS) or WECS clusters. Even for this particular application only four techniques appear to be operational now; that is, if used properly, these techniques should provide the data sets currently considered adequate for wind-energy siting purposes. They are, in rough order of increasing expense and operating demands: optical transverse wind sensors; acoustic Doppler sounders; time-of-flight and continuous wave (CW) Doppler lidar; and frequency-modulated, continuous wave (FM-CW) Doppler radar.

21984 **(DOE/NASA/20320—30) Test evaluation of a laminated wood wind turbine blade concept.** Faddoul, J.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). May 1981. Contract AI01-76ET20320. 46p. (NASA-TM—81719). NTIS, PC A03/MF A01. Order Number DE81024946.

Because of the high stiffness and fatigue strength of wood (as compared to density) along with the low cost manufacturing techniques available, a laminated wood wind turbine blade application has been studied. This report presents the results of the testing performed on elements of the wood blade-to-hub transition section which uses steel studs cast into a laminated wood spar with a filled epoxy. Individual stud samples were tested for both ultimate load carrying capability and fatigue strength. A one-time pull-out load of 78,000 lb was achieved for a 15 in. long stud with a diameter of 1 in. Tension-tension fatigue indicated that peak loads on the order of 40% of ultimate could be maintained as an endurance limit (mean load = 20,000 lb, cyclic load = +-15,000 lb). Following the individual stud testing, a full-scale inboard blade section (20 ft in length) was tested.

21985 **(PNL—3739) Candidate wind turbine generator site annual data summary for January 1980 through December 1980.** Sandusky, W.F.; Renne, D.S. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 126p. NTIS, PC A07/MF A01.

Summarized hourly meteorological data for fourteen candidate and wind turbine generator sites are presented in this report. These data are collected for the Department of Energy for the purpose of evaluating the wind energy potential at these sites and are used to assist in selection of potential sites for installation and testing of large wind turbines in electric utility systems. For each site, data are given in eight tables and one figure. Use of information from these tables, with information about specific wind turbines, should allow the user to estimate the potential for wind energy production at each site.

21986 **(SAND—80-2669) Guy-cable design and damping for vertical-axis wind turbines.** Carne, T.G. (Sandia National Labs., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 35p. NTIS, PC A03/MF A01.

Guy cables are frequently used to support vertical axis wind turbines since guying the turbine reduces some of the structural requirements on the tower. The guys must be designed to provide both the required strength and the required stiffness at the top of the turbine. The axial load which the guys apply to the tower, bearings, and foundations is an undesirable consequence of using guys to support the turbine. Limiting the axial load so that it does not significantly affect the cost of the turbine is an important objective of the cable design. The lateral vibration of the cables is another feature of the cable design which needs to be considered. These aspects of the cable design are discussed in this paper, and a technique for damping cable vibrations is mathematically analyzed and demonstrated with experimental data.

21987 **(SAND—80-2776) Accelerometer measurements of aerodynamic torque on the DOE/Sandia 17-m Vertical Axis Wind Turbine.** McNerney, G.M. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 20p. NTIS, PC A02/MF A01.

An experiment was conducted on the DOE/Sandia 17-m Vertical Axis Wind Turbine, using rotor shaft torque and rotor angular acceleration data to deduce the functional form of the aerodynamic torque. An analysis of the experiment, along with errors encountered, is presented and the results listed in both graphic and analytical form.

21988 **(SAND—81-1108C) Recent Darrieus vertical-axis wind turbine aerodynamical experiments at Sandia National Laboratories.** Klimas, P.C. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 8p. (CONF-810226—5). NTIS, PC A02/MF A01.

From 2. DOE/NASA wind turbine dynamics workshop; Cleveland, OH, USA (24 Feb 1981).

Experiments contributing to the understanding of the aerodynamics of airfoils operating in the vertical axis wind turbine (VAWT) environment are described. These experiments are ultimately intended to reduce VAWT cost of energy and increase system reliability. They include chordwise pressure surveys, circumferential blade acceleration surveys, effects of blade camber, pitch and offset, blade blowing, and use of sections designed specifically for VAWT application.

21989 **Wind driven direct water heating system development and field testing.** Gunkel, W.W. (Cornell Univ., Ithaca, NY); Lacey, D.R.; Neyeloff, S. pp 257-261 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineers (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

Results of the research project Wind Energy Substitution at Dairy Milking Centers are presented. The experimental wind system was comprised of a commercial wind turbine - the Pinson Cycloturbine - and a specially designed agitation-type water heater. A dimensional analysis was conducted to determine power absorption characteristics of the selected agitator design. Equations are presented to aid in the design of an agitator type energy conversion system that will be matched to the power output characteristics of any given wind turbine. The prototype wind turbine - agitator system was monitored continuously for nine months. Results of this field test are presented including available wind power density at the site, monthly energy output and operating time. Mechanical repair and maintenance experience with the system is included providing a complete record of operation of the wind driven direct water heating system.

21990 **Wind energy for agricultural heating.** Soderholm, L.H. (Dept. of Agriculture, Ames, Iowa). pp 262-265 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineers (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

Heating of farm structures consumes approximately 10 percent of the energy used in agricultural production in the United States. Heating of water for residence and dairy use also consumes a substantial amount of energy. The major sources of energy for heating in rural areas presently are from the use of two nonrenewable resources - oil and liquified petroleum (LP) gas. In many rural areas, wind energy can provide a substantial amount of the energy needed for agricultural heating applications. Use of wind energy as an alternative energy source for heating can both reduce use of nonrenewable energy and help electric power suppliers to serve additional electric heating loads by reducing the electrical demands on rural power distribution systems.

# 20 ELECTRIC POWER ENGINEERING

*REFER ALSO TO CITATION(S) 22106, 22134, 22166*

## 2001 Power Plants And Power Generation

*REFER ALSO TO CITATION(S) 21547, 21563, 21567, 21734, 21811, 22086, 22088, 22089, 22133, 22135, 22136, 22137, 22151, 22240*

21991 **(CONF-790145—4) Evaluation of boiler-tube materials for advanced power cycles.** Plumley, A.L.; Accortt, J.I.; Rozcniak, W.R. (Combustion Engineering, Inc., Windsor, CT (USA)). 1979. Contract AC01-76ET10501. 19p. (TIS—6105). NTIS, PC A02/MF A01.

From Meeting on erosion-corrosion of materials in coal conversion systems; Berkeley, CA, USA (24 Jan 1979).

A three-year laboratory and field investigation was completed during which selected commercial and advanced experimental materials and coatings were evaluated under conditions simulating advanced power cycles, i.e., in the 1300 to 1700°F metal temperature range associated with the liquid-coupled Rankine and closed Brayton power cycles under consideration. The materials and coatings were evaluated initially following exposure on controlled temperature probes in a solid fuel burning test furnace using coal feedstock of economic significance. The most promising materials were again evaluated after exposure for periods up to 8000h on probes under superheater conditions in operating boilers using the same feedstocks. The materials tested included standard and advanced austenitic stainless steels, and nimonic, inconel and incaloy alloys. The results showed that the Western subbituminous and Midwestern bituminous coals appeared to be somewhat more corrosive to the austenitic materials. No significant differences between coals were noted when the 800 series or cobalt based alloys were exposed while burning the various coals. (LCL)

21992 **(CONF-810567—1) Development support by ORNL for TVA AFBC Pilot Plant.** Holcomb, R.S.; Lackey, M.E.; Daw, C.S.; Zimmerman, G.P. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01.

From 64. chemical conference; Halifax, Nova Scotia, Canada (31 May 1981).

Oak Ridge National Laboratory (ORNL) has been involved for the past several years in the assessment, design and development of fluidized bed combustors. The current effort includes a development program for an AFBC-gas turbine industrial cogeneration plant, a PFBC utility plant assessment and design study, and technical and development support for the TVA Pilot Plant program. The FBC experience and R and D capabilities of ORNL complement the power plant design, construction and operating experience of TVA in the AFBC Pilot Plant program. The technical support provided by ORNL includes a number of analytical and experimental tasks in several area of AFBC technology. The major development effort has been in the areas of combustion performance and coal feeding. Sulfur capture performance data have been obtained in the ORNL Bench Scale Combustor for candidate limestones with once-through feeding and with fines recycle. The target performance of 90% $SO_2$ retention was achieved with a Ca/S mole ratio of 2.1 with fines recycle. A fundamental test program on the pneumatic transport of coal and coal-limestone mixtures was conducted to investigate the influence of particle size distribution, surface moisture and transport velocity, on pressure drop, saltation and plugging.

21993 (CONF-8003114—, pp 399-414) **Optimizing power plant coolant systems.** Bowman, C.F. (Tennessee Valley Authority, Knoxville, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The analysis methods used by TVA for the economic optimization of power plant cooling systems are described. Factors to be considered in such an analysis include the amount of heat to be dissipated, the heat sink used, i.e., surface waters or atmosphere, the means used for heat dissipation, i.e., cooling towers, spray ponds, and cooling lakes, and the design variables of construction and operating costs of the heat rejection system. Power plant waste heat utilization for greenhouse or space heating is also considered. (LCL)

21994 **(DOE/ET/10340—T3) High-temperature turbine technology program. Turbine subsystem design report: Low-Btu gas.** Horner, M.W. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Dec 1980. Contract AC01-76ET10340. 227p. NTIS, PC A11/MF A01.

The objective of the US Department of Energy High-Temperature Turbine Technology (DOE-HTTT) program is to bring to technology readiness a high-temperature (2600°F to 3000°F firing temperature) turbine within a 6- to 10-year duration, Phase II has addressed the performance of component design and technology testing in critical areas to confirm the design concepts identified in the earlier Phase I program. Based on the testing and support studies completed under Phase II, this report describes the updated turbine subsystem design for a coal-derived gas fuel (low-Btu gas) operation at 2600°F turbine firing temperature. A commercial IGCC plant configuration would contain four gas turbines. These gas turbines utilize an existing axial flow compressor from the GE product line MS6001 machine. A complete description of the Primary Reference Design-Overall Plant Design Description has been developed and has been documented. Trends in overall plant performance improvement at higher pressure ratio and higher firing temperature are shown. It should be noted that the effect of pressure ratio on efficiency is significally enhanced at higher firing temperatures. It is shown that any improvement in overall plant thermal efficiency reflects about the same level of gain in Cost of Electricity (COE). The IGCC concepts are shown to be competitive in both performance and cost at current and near-term gas turbine firing temperatures of 1985°F to 2100°F. The savings that can be accumulated over a thirty-year plant life for a water-cooled gas turbine in an IGCC plant as compared to a state-of-the-art coal-fired steam plant are estimated. A total of $500 million over the life of a 1000 MW plant is projected. Also, this IGCC power plant has significant environmental advantages over equivalent coal-fired steam power plants.

21995 **(DOE/ET/10340—T4) Development of high-temperature turbine subsystem technology to a technology readiness status, Phase II. Quarterly report, January-March 1981.** Horner, M.W. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Apr 1981. Contract AC01-76ET10340. 80p. (FE—1806-107). NTIS, PC A05/MF A01.

progress in developing a technical readiness vehicle (TRV) for demonstrating the performance of a combined-cycle power plant with high-temperature, 2600 to 3000°F firing temperature, gas turbines using coal-derived gas fuel is reported. Work on the combined-cycle power plant and TRV design, component development, aerodynamics studies, simulation, and fuel gas cleanup systems is described. (LCL)

21996 **(DOE/ET/10348—T2) High-temperature-turbine technology program. Phase II. Technology test and support studies. Technical progress report, April 1, 1979-June 30, 1979.** (Curtiss-Wright Corp., Wood-Ridge, NJ (USA). Power Systems Div.). Jul 1979. Contract AC01-76ET10348. 171p. (FE—2291-48A; CW-WR—76-02048A). NTIS, PC A08/MF A01.

Work performed on the High-Temperature-Turbine Technology Program, Phase II-Technology Test and Support Studies during the period from 1 April 1979 through 30 June 1979 is summarized. Objectives of the program elements as well as technical progress and problems during this Phase II quarterly reporting period are presented. Planned progress during the next quarterly reporting period is also defined. Testing of the LP rig engine with hot gas stream particulates simulating operation on low Btu gas is described. Fabrication of components and preparation of facilities for future tests of the Turbine Spool Technology Rig are discussed together with analytical reviews. Preparation of the low Btu gas synthesizing facility is discussed. Supporting Materials and Process investigations are described.

21997 **(DOE/ET/10373—T6) Granular bed filter development program, Phase II. Quarterly report, June-August 1980.** Moresco, L.L. (Combustion Power Co., Inc., Menlo Park, CA (USA)). May 1981. Contract AC21-77ET10373. 6p. NTIS, PC A02/MF A01.

During this period the program was redirected to obtain data on an improved version of the screenless moving Granular Bed Filter (GBF) rather than construct the device with the improvements incorporated and test at the Curtiss-Wright facility. Work in the interim was directed toward low temperature testing of the improved GBF and obtaining physical data for a numerical model of the GBF.

21998 **(DOE/ET/11313—1) Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981.** Kowalik, R.M.; Ruth, L.A.; Edelman, R.B.; Wong, E.; Farmer, R.C. (Exxon Research and Engineering Co., Linden, NJ (USA); Science Applications, Inc., Canoga Park, CA (USA)). May 1981. Contract AC22-77ET11313. 83p. NTIS, PC A05/MF A01.

Recent efforts under this contract have involved (1) investigations of soot production phenomena in gas phase jet-stirred combustors, (2) preliminary experiments concerning the effects of liquid spray fuel injection on soot production in jet-stirred combustors, (3) development and shakedown of ER & E's new Variable Pressure Jet-Stirred Combustor, and (4) continued development of SAI's quasi-global chemical kinetic model of hydrocarbon combustion/soot production processes. Progress in each of these subject areas, including experimental results from the first two areas, detailed descriptions of the Variable Pressure Jet-Stirred Combustor and the present quasi-global model, and brief outlooks on future experimental and modeling efforts are discussed. Results from the gas phase jet-stirred combustor studies provide information regarding a possible soot formation mechanism change at 1800°K, the appropriateness of a separate sooting category for 1-methylnaphthalene and other multiring aromatics, the identification of unburned hydrocarbons in the exhaust gases, and the dependencies of soot properties on combustor operating conditions. The liquid fuel spray experiments provide data which relate liquid spray soot yields to fuel type, overall equivalence ratio, atomizing air flow rate, and combustor temperature. Of particular significance is the temperature dependence of the soot yield, which was found to be exactly opposite previous trends obtained in gas phase jet-stirred combustors. The description of the Variable Pressure Jet-Stirred Combustor includes the actual combustor, its versatile air and fuel supply systems, and associated instrumentation and diagnostics. The quasi-global model description contains tentative reaction mechanisms and rate constants and comparisons of model calculations with experimental data.

21999 **(DOE/ET/12292—T1) Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils.** Shen, S. (Airco Temescal Div., Berkeley, CA (USA)). 1980. Contract AC03-78ET12292. 58p. NTIS, PC A04/MF A01.

The main objective of this program is to obtain a ceramic coating with sufficient density to prevent hot-corrosion element diffusion while accommodating the thermal induced stresses and strain encountered in the gas turbine airfoil application. A secondary objective is to include ceramic coatings for outer air seals and combustor components such as falseheads, crossover tubes, and igniters. In addition, these coatings may directly, or with minor modification, be of major interest for insulating diesel engine combustion zones. The application objective is to significantly enhance diesel and gas turbine engine durability when operating with minimally processed alternative fuels. Both steel tabs and IN-738 pins were used as substrate to be coated with Yttria-stabilized Zirconia using EB-PVD technique. Various bond layers including CoCrAlY, NiCrAlY and NiCoCrAlY were also deposited by PVD in a 100 kW coater followed by glass bead peening and vacuum heat-treatment at 1975°F for four (4) hours. $ZrO_2(Y_2O_3)$ top layers were deposited in a 200 kW coater with a pressure barrier system to enable oxygen gas being introduced during the coating process. Results are presented and discussed. (WHK)

22000 **(DOE/ET/17091—T1) Electrocyclone development program. Quarterly technical report, November 1980-January 1981.** (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). 1981. Contract AC21-80ET17091. 38p. (FE—7091-6). NTIS, PC A03/MF A01.

Progress is reported in research on the use of applied electrostatics to enhance the performance of large cyclone collectors for cleaning hot exhaust gases from pressurized fluidized bed combustors in coal-fired power plants. The electrocyclone design parameters, electrode configuration tests, and electrostatic component development are discussed. (LCL)

22001 **(DOE/MC/16230—152) Rivesville multicell fluidized bed boiler. Annual technical progress report. July 1978-June 1979.** (Pope, Evans and Robbins, Inc., New York (USA)). Aug 1980. Contract AC21-81MC16230. 305p. NTIS, PC A14/MF A01.

Design, construction and test program of a 300,000 lb/hr steam generating capacity multicell fluidized bed boiler (MFB), as a pollution free method of burning high-sulfur or highly corrosive coals, is being carried out. The concept involves burning fuels such as coal, in a fluidized bed of limestone particles that react with the sulfur compounds formed during combustion to reduce air pollution. Nitrogen oxide emissions are also reduced at the lower combustion temperatures. The $CaSO_4$ produced in the furnace is discharged with the ash or regenerated to CaO for reuse in the fluidized bed. Information is presented on continued operation of the Rivesville MFB steam generating plant in a commercial mode and for determining performance and emission characteristics; studies and tests on flyash characterization and reinjection, fuel feed eductors and needles, air distributor, corrosion-erosion and sulfur capture; engineering studies to improve MFB performance and reliability.

22002 **(DOE/MC/16230—153) Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, October-December 1979.** (Pope, Evans and Robbins, Inc., New York (USA)). 1980. Contract AC21-81MC16230. 61p. NTIS, PC A04/MF A01.

The objective of this program is to design, construct and test a multicell fluidized-bed boiler as a pollution-free method of burning high-sulfur or highly corrosive coals without excessive maintenance problems. The fluidized-bed boiler will provide approximately 300,000 pounds of steam per hour. Steam pressure and temperature conditions were selected to meet requirements of the site at which the boiler was installed.

22003 **(DOE/MC/16230—156) Rivesville multicell fluidized bed boiler.** (Pope, Evans and Robbins, Inc., New York (USA)). Mar 1981. Contract AC21-81MC16230. 83p. NTIS, PC A05/MF A01.

One objective of the experimental MFB at Rivesville, WV, was the evaluation of alternate feed systems for injecting coal and limestone into a fluidized bed. A continuous, uniform feed flow to the fluid bed is essential in order to maintain stable operations. The

feed system originally installed on the MFB was a gravity feed system with an air assist to help overcome the back pressure created by the fluid bed. The system contained belt, vibrating, and rotary feeders which have been proven adequate in other material handling applications. This system, while usable, had several operational and feeding problems during the MFB testing. A major portion of these problems occurred because the coal and limestone feed control points - a belt feeder and rotary feeder, respectively - were pressurized in the air assist system. These control points were not designed for pressurized service. An alternate feed system which could accept feed from the two control points, split the feed into six equal parts and eliminate the problems of the pressurized system was sought. An alternate feed system designed and built by the Fuller Company was installed and tested at the Rivesville facility. Fuller feed systems were installed on the north and south side of C cell at the Rivesville facility. The systems were designed to handle 10,000 lb/hr of coal and limestone apiece. The systems were installed in late 1979 and evaluated from December 1979 to December 1980. During this time period, nearly 1000 h of operating time was accumulated on each system.

22004 **(EPRI-CS—1760) Assessment of the use of human factors in the design of fossil-fired steam-generating systems. Final report.** Oliver, J.A.; Baker, J.E.; Roth, J.W. (Whitston Associates, Pasadena, CA (USA)). Apr 1981. 119p. NTIS, PC A06/MF A01.

A method was developed by the contractor which can be used to evaluate the level of implementation of established Human Factors data and principles in the design of a present or future fossil fired power plant, or any major subsystem contained therein. The methodology is based on knowing the distribution of human error between three generic locations within the plant that are common to all major subsystems, and the importance of twelve representative, all inclusive Human Factors Variables, as weighed by knowledgeable utility industry personnel regarding their impact on the performance of operating and maintenance personnel in these generic plant locations. From this input a mathematical expression was developed whereby scores, corresponding to the level of implementation of the selected Human Factors Variables to any plant or subsystem contained therein, could be assigned. This evaluation technique was applied to three modern fossil-fired steam generating systems for verification of its adequacy. Results are presented in terms of comparisons of the three fossil fired steam generating systems to both the Electric Utility Industries and All Industries use of Human Factors data and principles during plant design. Areas for further research and development are indicated.

22005 **Coal-fired powerplants' Federal permit status report. Fourth edition.** Washington, DC; Office of Management and Budget (1980). 116p. (NP—1902447). Publications Office, Washington, DC.

Increased use of coal is essential to reduce US reliance on imported oil. The Office of Management and Budget established the Permit Review Assessment Task Force for Coal-Fired Powerplants and Coal Mines to determine to what extent administrative aspects of permitting are impeding planned construction and operation of new coal-fired powerplants and mines. The Permit Review Assessment Task Force has identified the major Federal permits required for coal-fired powerplants and the facilities presently in the permitting process. Its purpose is to track the permitting status of these facilities. A specific Federal permit is not required for a coal-fired powerplant to commence operation. However, most coal-fired powerplants are required to have one or more Federal permits before construction. The major Federal permits trackd by the Task Force are listed along with the responsible Federal agency.

22006 **(DOE/MC/16230—155) Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, July-September 1980.** (Pope, Evans and Robbins, Inc., New York (USA)). [nd]. Contract AC21-81MC16230. 17p. NTIS, PC A02/MF A01.

The objective of this program is to design, construct and test a multicell fluidized-bed boiler as a pollution-free method of burning high-sulfur or highly corrosive coals without excessive maintenance problems. The fluidized-bed boiler will provide approximately 300,000 lb of steam per h. Steam pressure and temperature conditions were selected to meet requirements of the site at which the boiler was installed.

## 2002 Environmental Aspects

*REFER ALSO TO CITATION(S) 21540, 21596, 22001, 22002, 22003, 22006, 22010, 22229, 22464, 22536, 22537, 22553*

22007 **(CONF-810545—2) Section 316(b) and modeling of ichthyoplankton entrainment.** Vaughan, D.S. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01.

From 3. conference on waste heat management and utilization; Miami, FL, USA (12 May 1981).

Section 316(b) of the Federal Water Pollution Control Act Amendments of 1972 requires the use of best technology available for minimizing adverse environmental impacts due to operation of intake systems by cooling water users such as steam electric power plants. One significant form of impact resulting from cooling water use is entrainment mortality of ichthyoplankton. Two basic modeling approaches were used to assess the impacts of ichthyoplankton entrainment, the equivalent adult method and age-structure models. Various assumptions and conventions associated with the equivalent adult method, which can lead to a serious underestimate of the potential loss of adults, are discussed. Possible methods for partially correcting some of these biases are suggested. The age-structure modeling approach suffers from fewer sources of bias than does the equivalent adult method, and provides a means for assessing long-term impacts of entrainment on fish populations. However, because of the difficulty in estimating density-dependent coefficients, ranges of estimates of long-term impacts on fish populations should be obtained.

22008 **(DOE/FC/10182—T12) Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4.** Downs, J.L. (Meteorology Research, Inc., Altadena, CA (USA)). 6 May 1981. Contract AC18-80FC10182. 50p. (MRI—81-R1805). NTIS, PC A03/MF A01.

The average particulate removal efficiency of the module tested was 99.1 percent, as calculated from the instack filter results. The impactor total mass loading results are in good agreement with those measured with the instack filters. The size dependent particulate removal by the scrubber may be characterized by the size at 50 percent collection efficiency, or cut point of the scrubber. The cut point is about 0.35 micrometer physical diameter or about 0.7 micrometer aerodynamic diameter, which is typical for a venturi with about 13 inches water volume pressure drop. The $SO_2$ concentrations measured with the continuous monitors are believed to be more accurate than those measured by the plant's instruments or by wet chemical methods. On the average, based on the instack filter results, 0.47 percent of the particulate mass loading at the inlet is sulfate. At the outlet, this fraction increases to 18 percent. The absolute amount of sulfate is roughly the same at inlet and outlet. The reason for this increase in relative sulfate concentratin can be seen from the impactor results. The sulfate fraction is greatest, at both the inlet and outlet, in the size range smaller than 0.3 micrometer. This size particle is collected relatively inefficiently by the scrubber, and so remains in the flue gas. A significant fraction of this small sulfate aerosol is probably sulfuric acid formed by condensation of $SO_3$ with water. The inlet temperature was about equal to the acid dew point, and the outlet temperature was well below the acid dew point. It should be noted that about 99 percent of the sulfur present in the flue gas stream at the inlet and about 96 percent at the outlet was in the form of $SO_2$. Therefore, the potential amount of secondary sulfate aerosol was much greater than the primary sulfate aerosol present.

## 2003 Power Transmission And Distribution

*REFER ALSO TO CITATION(S) 21751, 21752, 21812, 22128, 22129, 22130, 22131, 22132, 22135*

22009 **(CONF-7909201—) Symposium on power and measurement transformers.** (Consiglio Nazionale delle Richerche (Italy). Gruppo di Macchine Elettriche). 1979. 335p. NTIS (US Sales Only), PC A15/MF A01.

From Symposium on power and measurement transformers; Positano, Italy (11 Sep 1979).

Thirty-eight papers were presented at the meeting. A separate abstract was prepared for each of 8 papers. The remaining 30 papers were not in scope for the data base. (LCL)

22010 **(DOE/EIS—0060) Proposed fiscal year 1981 program. Final environmental impact statement.** (Bonneville Power Administration, Portland, OR (USA)). Oct 1980. 332p. NTIS, PC A15/MF A01.

The Fiscal Year 1981 Proposed Program of the Bonneville Power Administration would result in the removal of approximately 1163 to 1644 acres (465 to 658 ha) of forest land from timber production: the permanent removal of all vegetative cover from approximately 246 to 259 acres (98 to 104 ha) as a result of the construction of the new substations, transmission lines, and permanent access roads; removal of approximately 22 to 25 acres (9 to 10 ha) of cropland from production; vegetation control measures which will reduce vegetative cover on approximately 18,646 acres (7544 ha) of existing right-of-way and 780 acres (316 ha) of existing substation property by the use of herbicides and manual cutting; effects both beneficial and adverse on existing wildlife habitat which would occur as a result of construction and maintenance activities as indicated above; impacts to fisheries and aquatic organisms as represented by the waterways or tributary streams that would be crossed during construction; visual impacts to scenic resources; introduction of combustion byproducts into the atmosphere as a result of open burning of slash from clearing forest land;soil erosion from the clearing, construction, and maintenance activities involved in the proposed program; audible noise during operation of construction equipment and transmission lines and substations; risk of man-caused accidents; and maintenance of a high standard of living and level of productivity for the Pacific Northwest through continued availability of reliable electric service. No decision on the proposed action shall be made until January 5, 1981.

22011 (DOE/EP—0005, pp 247-289) **Analysis of bulk-power-system failures and review of utility security and restoration procedures.** Apr 1981. NTIS, PC A25/MF A01.

In National electric reliability study: technical study reports.

Several major power-system failures have elicited public concern regarding the reliability of power systems. This concern is reflected in the Public Utility Regulatory Policies Act of 1978 (PURPA), which mandates a study of power-system reliability. One part of this study is discussed here. An analysis of DOE/ERA bulk-power-system failure data reported for the period January 1967-June 1979 is used to identify four dominant generic problems. A literature survey and four case studies of selected utilities are used to review utility security and restorative procedures. Based upon this analysis and review, recommendations are made for alleviating the dominant problems by improving utility security and restoration practices and system design.

22012 **(DOE/ET/29068—T5) Evaluation, design, development and delivery of a 1200-kV prototype termination. Ninth technical progress report, December 1, 1980-February 28, 1981.** Billings, J.S.; Fischer, W.H. (Westinghouse Electric Corp., Trafford, PA (USA). Power Circuit Breaker Div.). 30 Apr 1981. Contract AC01-78ET29068. 26p. NTIS, PC A03/MF A01.

Tests are continuing on the shatter-resistant weathercase models and small samples. Two epoxy weathercase material samples are still undergoing accelerated tensile creep tests. Progress is reported on the design of the full scale prototype termination.

22013 **Laboratory development of /plus or minus/600 kV dc pipe cable system.** Allam, E.M. Sr.; McKean, A.L. (Phelps Dodge Cable and Wire Co, Yonkers, NY). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; IEEE Power Engineering Society (1980).

From IEEE PES summer meeting; Minneapolis, MN, USA (Jul 1980).

Final results of a U.S. DOE-sponsored development program for a DC pipe cable system are summarized, providing a basis for optimized design. Long-term performance of DC cable models under accelerated stress provides essential data regarding operating safety factors. Design requirements for optimum performance are discussed in relation to future commercial system applications. Close-to-optimal cable and accesories are recommended for Waltz Mill, based upon laboratory test results and with due cognizance of modern arrestor protective capabilities and system coordination. 10 refs.

22014 **Wave propagation in a dc superconducting cable--1. Analysis.** Chowdhuri, P.; Mahaffy, M.A. (Los Alamos Sci Lab, NM). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; IEEE Power Engineering Society (1980).

From IEEE PES summer meeting; Minneapolis, MN, USA (Jul 1980).

The authors consider a dc superconducting cable design consisting of four concentric metallic cylinders, of which two carry the load current and two comprise the cryogenic enclosure. When a transient voltage is impressed across such a cable, the major dielectric may not be fully stressed to its design value, and unwanted voltage stresses may develop across other parts of the cable. This paper analyzes the surge-voltage propagation characteristics of a four-conductor dc superconducting cable for a step-function input voltage. This analysis, although mainly directed to superconducting cables, is also applicable to other multiconductor transmission lines. A companion paper discusses the parametric effects of the cable system in optimizing the voltage distribution. 25 refs.

22015 **Investigation of corona and field effects of ac/dc hybrid transmission lines.** Chartier, V.L.; Sarkinen, S.H.; Stearns, R.D.; Burns, A.L. (US DOE, Portland, Oreg). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; IEEE Power Engineering Society (1980).

From IEEE PES summer meeting; Minneapolis, MN, USA (Jul 1980).

This paper describes laboratory and analytical studies that have been conducted by The Bonneville Power Administration to determine corona and electric field effects of a proposed ac/dc hybrid transmission line. The proposed hybrid line would consist of a 500 kV ac circuit operating on the same structure as a /plus or minus/500 kV dc circuit. Generally, the laboratory studies show that, with some modifications, equations used at BPA for calculating corona phenomenon can be used for a hybrid line. The paper also describes a technique for estimating dc electric field parameters which are enhanced by the presence of ions. 15 refs.

22016 **Impedance characteristics of large tower footings to a 100/mu/s wide square wave of current.** Rogers, E.J. (Bonneville Power Adm, Portland, Oreg). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; IEEE Power Engineering Society (1980).

From IEEE PES summer meeting; Minneapolis, MN, USA (Jul 1980).

Tests were performed using a 2500 volt pulse generator, to determine impedance variations of six tower footings on the BPA 1100 kV test line. Comparisons were made with the tower's low frequency resistance. An electrical model, made with Triax Cable, is used to confirm major inflection points of impedance variations for one tower leg grillage. 3 refs.

22017 **End-use approach to demand forecasting.** Broehl, J.H. (Battelle, Columbus Lab, Ohio). pp vp of IEEE Power Engineering Society summer meeting. Piscataway, NJ; IEEE Power Engineering Society (1980).

From IEEE PES summer meeting; Minneapolis, MN, USA (Jul 1980).

This paper describes an extension of the end-use approach to demand forecasting and loadshape analysis. In the approach a clear distinction between the pattern of usage and the level of usage is made. The pattern of usage for a particular end-use is defined by a sequence of use factors. For weather insensitive end-uses, the use factors are functions of time (i.e., time of day, day type, and

month); while for the weather sensitive end-uses, they are functions of time as well as a composite weather variable. The model structure has been implemented successfully for a number of utilities to analyze and simulate system loadshapes under different assumptions.

**22018 Coordination of economic dispatch and load-frequency control in electric power systems.** Kwatny, H.G.; Athay, T.A. (Drexel Univ, Philadelphia, Pa). *Proceedings of the IEEE Conference on Decision and Control ;* **2**: 703-714(1979). (CONF-791222—).

From 18. IEEE conference on decision and control; Fort Lauderdale, FL, USA (12 Dec 1979).

This work deals with the coordination of the economic dispatch and regulation functions of automatic generation control in electric power systems. The point of view taken is that such coordination appropriately takes place at the regulation or load-frequency control level. The coordinating controller is obtained thru the formulation of a suitable extended load-frequency control problem in the context of linear multivariable control theory. 17 refs.

**22019 Statistical synthesis of power system functional load models.** Chong, C.Y.; Debs, A.S. (Ga Inst of Technol, Atlanta). *Proceedings of the IEEE Conference on Decision and Control ;* **1**: 264-269(1979). (CONF-791222—).

From 18. IEEE conference on decision and control; Fort Lauderdale, FL, USA (12 Dec 1979).

Functional load models characterize the load demand portion of a component load when the influence factors are weather, and human use patterns, etc. Physically based functional load models for individual components are proposed. From these the functional load model of a large number of similar components is obtained by statistical aggregation. 15 refs.

**22020 Algebraic aggregation of interconnected power system loads.** Ihara, S. (GE, Schenectady, NY). *Proceedings of the IEEE Conference on Decision and Control ;* **1**: 270-272(1979). (CONF-791222—).

From 18. IEEE conference on decision and control; Fort Lauderdale, FL, USA (12 Dec 1979).

The electrical power system loads, as seen from a substation level, consist of numerous load elements and network elements. A subsystem consisting of load elements which are interconnected by network elements is connected to the rest of the power system at several points called reference nodes. This paper is concerned with a description of interconnected loads for a study of their interactions with the rest of the system through the reference nodes. The voltages at the reference nodes are the electrical inputs to the interconnected loads. Only balanced phase operations of symmetrical three phase loads are considered. The voltage dependencies of individual load elements are algebraically aggregated into a voltage dependent admittance matrix which describes the interconnected loads explicitly in terms of the voltages at the reference nodes.

**22021 Economic dispatch with generation constraints.** Fahmideh-Vojdani, A.R.; Galiana, F.D. (McGill Univ, Montreal, Que). *Proceedings of the IEEE Conference on Decision and Control ;* **2**: 697-702(1979). (CONF-791222—).

From 18. IEEE conference on decision and control; Fort Lauderdale, FL, USA (12 Dec 1979).

The classical procedure for solving the economic dispatch problem in the presence of upper and lower limits on the generation levels may fail to lead to the constrained optimum generation schedule. In this study, a simple scheme suitable for real time applications which resolves this drawback is presented. When transmission losses are neglected, the constrained optimum can be analytically computed based on a distance measure of the unconstrained optimum schedule to the violated limits. In the presence of transmission losses, the problem is first converted into an equivalent lossless case by a simple transformation which can then be solved by the proposed algorithm. 9 refs.

**22022 Robust control of multiterminal dc/ac systems.** Lehtomaki, N.A.; Chan, S.M.; Sandell, N.R. Jr.; Athans, M.; Carrig, J.; Grund, C.E.; Nozari, F.; Hauth, R. (MIT, Cambridge, Mass). *Proceedings of the IEEE Conference on Decision and Control ;* **2**: 886-896(1979). (CONF-791222—).

From 18. IEEE conference on decision and control; Fort Lauderdale, FL, USA (12 Dec 1979).

Although this study presents a general design methodology for an MTDC system, a hypothetical, five-terminal dc/ac system is used as an example to illustrate the steps of the design process. The model of this system is described and a physical interpretation of the design model for a modal perspective is given. This work also shows how the physical insights can be used to construct a state penalty matrix for an LQ design, and the concept of gain observability is utilized to study the trade-off between the LQ centralized design and other decentralized schemes. The robustness of the control design is studied. Some results of the open- and closed-loop systems are compared. 7 refs.

# 21 NUCLEAR POWER PLANTS

*REFER ALSO TO CITATION(S) 22133*

**22023 (DOE/TIC—8200-R43) Nuclear reactors built, being built, or planned in the United States as of December 31, 1980.** (Department of Energy, Oak Ridge, TN (USA). Technical Information Center). Apr 1981. 44p. NTIS, PC A03/MF A01.

Nuclear Reactors Built, Being Built, or Planned contains unclassified information about facilities built, being built, or planned in the United States for domestic use or export as of December 31, 1980, which are capable of sustaining a nuclear chain reaction. Information is presented in five parts, each of which is categorized by primary function or purpose: civilian, military, production, export, and critical assembly facilities.

**22024 Application of pattern recognition techniques to a flying robotic arm.** Boykin, W.H.; Warren, M.E. (Syst Dyn Inc, Gainesville, Fla). *Proceedings of the IEEE Conference on Decision and Control ;* **2**: 802-805(1979). (CONF-791222—).

From 18. IEEE conference on decision and control; Fort Lauderdale, FL, USA (12 Dec 1979).

Aging nuclear power plants and tightening radiation dosage regulations for maintenance workers could very well cause future nuclear reactor maintenance to be mostly done by remote manipulators and robotic devices. The need for such remote systems is likely to appear before purely automatic devices become feasible. It is felt that pattern recognition techniques will be used and that they can reduce the operator work load in near-term systems. Several concepts in the use of TV image recognition techniques for control of links of a manipulator arm are presented. Equations of motion and control laws for two cases are developed. Initial results indicate that in some tasks this human operator hand-off of hand-eye coordination to machine can improve information to operator and speed of operation and will reduce operator fatigue. 10 refs.

## 2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

*REFER ALSO TO CITATION(S) 21716, 22083*

## 2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

*REFER ALSO TO CITATION(S) 21716, 22046, 22057, 22067, 22071, 22075, 22076, 22082, 22084*

**22025 (ALO—137) Evaluation of the nucledyne passive containment system.** (Gilbert/Commonwealth, Reading, PA (USA); Westinghouse Electric Corp., Pittsburgh, PA (USA)). Apr 1981. Contract AC04-76DP00789. 216p. NTIS, PC A10/MF A01.

This reports contains: (1) an evaluation by Gilbert/Commonwealth (G/C) of the NucleDyne passive Containment System (PCS) as that conceptual design is applied to a Westinghouse, two loop, Pressurized Water Reactor; (2) an evaluation by Westinghouse of two questions about the impact of the PCS on the Nuclear Steam Supply System (NSSS), which were posed by G/C and best answered by an NSSS vendor; and (3) replies to both the Gilbert/

Commonwealth report and the Westinghoue report by NucleDyne Engineering Corporation.

**22026 (GEND—016) Accountability study for TMI-2 fuel.** Goris, P.; Scott, D.D. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1981. Contract AC07-76ID01570. 145p. NTIS, PC A07/MF A01.

The TMI-2 accountability study considers problems of identifying, measuring, and accounting for TMI-2 fuel in the resident condition, as it is removed from the reactor, during subsequent cleanup, and during post-removal examinations. The goal is to identify methods and procedures which will provide a verifiable material balance equating to the pre-accident balance.

**22027 (HEDL-TME—80-85) Data summary report for the destructive examination of Rods G7, G9, J8, I9, and H6 from Turkey Point Fuel Assembly B17.** Davis, R.B.; Pasupathi, V. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1981. Contract AC14-76FF02170. 135p. NTIS, PC A07/MF A01.

Destructive examination results of five spent fuel rods from a Turkey Point Unit 3 pressurized water reactor are reported. Examinations included fission gas analysis, cladding hydrogen content analysis, fuel burnup analysis, metallographic examination, autoradiography and shielded electron microprobe analysis. All rods were found to be of sound integrity with an average burnup of 27 GWd/MTU and a 0.3% fission gas release.

**22028 (UCI—18966) Technical evaluation of the adequacy of station electric distribution system voltages for the Yankee Rowe Nuclear Power Station.** Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 29 May 1981. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01.

This report documents the technical evaluation of the adequacy of the station electric distribution system voltages for the Yankee Rowe Nuclear Power Station. The evaluation is to determine if the onsite distribution system, in conjunction with the offsite power sources, has sufficient capacity to automatically start and operate all Class 1E loads within the equipment voltage ratings under certain conditions established by the Nuclear Regulatory Commission. The analysis shows that the station electric distribution system has the capacity and capability to supply voltage to the Class 1E equipment with their design ratings for the worst case loading condition.

## 2103 Power Reactors, Non-breeding, Graphite Moderated

*REFER ALSO TO CITATION(S) 22047, 22048, 22049, 22050*

**22029 Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers.** Lai, G.Y. (Gen At Co, San Diego, Calif). *Thin Solid Films ;* **64**: No. 2, 271-280(Apr 1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

Some important factors to be considered for using sprayed coatings in gas-cooled reactor heat exchangers are discussed. These factors include (a) high temperature gaseous corrosion, (b) thermal stability of coatings, (c) metallurgical compatibility between the coating and the substrate and (d) effects of the coating on the mechanical properties of the substrate alloy. The wear properties of the coatings are also important but will not be discussed in this paper. The coatings evaluated were Cr/sub 3/C/sub 2/-(NI-Cr)andCr/sub 23/C/sub 6/-(Ni-Cr) applied by either the plasma arc or the detonation gun process.

## 2105 Power Reactors, Breeding

*REFER ALSO TO CITATION(S) 21811, 22050, 22064, 22066, 22072, 22073*

**22030 Natural convection analyses and verification for LMFBR cores.** Coffield, R.D.; Markley, R.A. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.); Khan, E.U. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Nuclear Engineering and Design ;* **62**: No. 1-3, 181-198(Dec 1980).

Analytical model requirements for core natural convection analyses are reviewed. Then results from current modeling on intra-assembly flow and heat redistribution are compared with several sources of experimental data. Also, data are described on low flow rod bundle hydraulic characteristics. Numerous sensitivity studies are also presented which show the effect and importance of various parameters on core temperatures during natural circulation, including inter-assembly flow redistribution, pump flow coastdown, rod size and fuel type, control system scram worth and shutdown power level. A system of codes for making the natural circulation predictions is also described, i.e., a plant-wide dynamic code, a whole-core system of dynamic code and a hot channel dynamic analysis code. The overall approach of verifying the core related codes is presented, along with the interaction and linkage between all the codes. Confirmation of this system of three codes will be through prototypic data obtained from EBR-II and FFTF natural circulation experiments.

**22031 (CONF-810615—2) Status of the CRBRP steam-generator design.** Schmidt, J.E.; Martinez, R.S.; Murdock, J.F. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Jun 1981. Contract AC15-76CL02395. 34p. NTIS, PC A03/MF A01.

From 2. joint US/Japan LMFBR steam generator seminar; Sunnyvale, CA, USA (1 Jun 1981).

Fabrication of the Prototype Unit is near completion and will be delivered to the test site in August, 1981. The Plant Unit design is presently at an advanced stage and will result in steam generator units fully capable of meeting all the requiments of the CRBRP Power Plant.

**22032 (CONF-810625—13) Experimental benchmark for piping system dynamic-response analyses.** (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). 1981. Contract AC15-76CL02395. 9p. NTIS, PC A02/MF A01.

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

This paper describes the scope and status of a piping system dynamics test program. A 0.20 m(8 in.) nominal diameter test piping specimen is designed to be representative of main heat transport system piping of LMFBR plants. Particular attention is given to representing piping restraints. Applied loadings consider component-induced vibration as well as seismic excitation. The principal objective of the program is to provide a benchmark for verification of piping design methods by correlation of predicted and measured responses. Pre-test analysis results and correlation methods are discussed.

**22033 (CONF-810625—14) Implications of stress range for inelastic analysis.** Karabin, M.E.; Dhalla, A.K. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). 1981. Contract AC15-76CL02395. 11p. NTIS, PC A02/MF A01.

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

The elastic stress range over a complete load cycle is routinely used to formulate simplified rules regarding the inelastic behavior of structures operating at elevated temperature. For example, a 300 series stainless steel structure operating at elevated temperature, in all probability, would satisfy the ASME Boiler and Pressure Vessel Code criteria if the linearized elastic stress range is less than three times the material yield strength. However, at higher elastic stress ranges it is difficult to judge, a priori, that a structural component would comply with inelastic Code criteria after a detailed inelastic analysis. The purpose of this paper is to illustrate that it is not the elastic stress range but the stress intensities at specific times during a thermal transient which provide a better insight into the inelastic response of the structure. The specif-

ic example of the CRBRP flued head design demonstrates that the temperature differential between various parts of the structure can be changed by modifying the insulation pattern and heat flow path in the structure, without significantly altering the elastic stress range over a complete load cycle. However, the modified design did reduce the stress intensity during steady state elevated temperature operation. This modified design satisfied the inelastic Code criteria whereas the initial design failed to comply with the strain accumulation criterion.

22034 **(CONF-810625—16) Simplified inelastic analysis procedure to evaluate a butt-welded elbow end.** Dhalla, A.K. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). 1981. Contract AC15-76CL02395. 20p. NTIS, PC A02/MF A01.

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

In a thin-walled piping network, the end of an elbow welded to a straignt pipe constitutes one of the highly stressed cross-sections that require structural evaluation. Explicit rules are not provided in the ASME Code for structural evaluation of the elbow ovalization and fabrication effects at the welded end. This paper presents a conservative semi-analytical procedure that can be used with simplified inelastic analysis to evaluate the elbow cross section welded to the straight pipe. The concept of carry-over factors is used to obtain ovalization stresses or strains at the elbow end. The stresses introduced by material and geometric nonuniformities in the fabrication process are then added to the ovalization stresses to complete structural evluation of the girth butt-welded elbow joint.

22035 **(DOE/ET/37241—45) MIT LMFBR blanket research project. Quarterly progress report, October 1, 1980-December 31, 1980.** Driscoll, M.J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 26 Mar 1981. Contract AS02-76ET37241. 47p. NTIS, PC A03/MF A01.

Information on heterogeneous assembly evaluation is presented concerning ringed moderator description and flux trap description; cross section generation; ringed moderator results; effects of heterogeneous moderation; sodium void worth breakdown; flux trap configuration; flux trap results; the effects of stoichiometric variation in the moderator; and the effects of lattice representation. Also discussed is the engineering compatibility of heterogeneous assembly designs.

22036 **(HEDL-SA—2175) Irradiated mixed-oxide-fuel and fission-gas-release behavior during ex-reactor thermal-transient tests.** Randklev, E.H.; Hinman, C.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 1980. Contract AC14-76FF02170. 22p. (CONF-801034—10). NTIS, PC A02/MF A01.

From 33. ACS Pacific Coast meeting; San Francisco, CA, USA (28 Oct 1980).

The subject of this discussion is the resultant experimental data on fission gas release and resultant fuel behavior obtained from a series of laboratory thermal transient tests (FGR) performed at HEDL. The test system involved a resistance heated tungsten furnace capsule and a quadrapole mass spectrometer for monitoring gas release. The test specimens were axial segments of fast neutron irradiated mixed oxide (75 wt % $UO_2$-25 wt % $PuO_2$) fuel pins of ~ 5 atom % burnup from the EBR-II reactor in Idaho.

22037 (LA—8797-PR, pp 59-64) **Thermomechanics.** Apr 1981. NTIS, PC A05/MF A01.

In Energy technology. Progress report, October-December 1980.

Progress in the Thermomechanics programs is reported with the completion of the third GCFR Full Length Subgroup (FLS-3) experiment in the natural convection loop and the on-going analysis of the results. The report summarizing the terminated GCFR program is in preparation. The requirements for a computer code to aid in the prediction of structural stability of in-situ oil shale retorts have been specified. Work in the Aquifer Dislocation program has concentrated on solving the unsteady well drawdown problem in two dimensions. Further effort to clarify the nature of the flow resistance coefficient in the case of nonlinear dependence of pressure gradient on fluid velocity is reported.

22038 **(ORNL—5711) BOLD VENTURE COMPUTATION SYSTEM for nuclear reactor core analysis, Version III.** Vondy, D.R.; Fowler, T.B.; Cunningham, G.W. III. (Oak Ridge National Lab., TN (USA)). Jun 1981. Contract W-7405-ENG-26. 330p. NTIS, PC A15/MF A01.

This report is a condensed documentation for VERSION III of the BOLD VENTURE COMPUTATION SYSTEM for nuclear reactor core analysis. An experienced analyst should be able to use this system routinely for solving problems by referring to this document. Individual reports must be referenced for details. This report covers basic input instructions and describes recent extensions to the modules as well as to the interface data file specifications. Some application considerations are discussed and an elaborate sample problem is used as an instruction aid. Instructions for creating the system on IBM computers are also given.

22039 **(ORNL/TM—7714) GCFR plenum shield design: shield heterogeneity experiment.** Muckenthaler, F.J.; Hull, J.L.; Manning, J.J. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 64p. NTIS, PC A04/MF A01.

This report presents measurements of neutron fluxes made in the Shield Heterogeneity Study of at the Tower Shielding Facility (TSF) for the Gas Cooled Breeder Reactor (GCFR) shielding program. The study consisted of mockups of selective neutron streaming paths in the outer radial shield surrounding the 300 MW(e) reactor. The experimental configurations included four basic segments: a straight planar slit through a graphite slab; a straight planar slit through an iron spacer between graphite walls; straight planar slits through the iron spacer and between the iron and graphite; an offset slit through graphite.

22040 **(ORNL/TM—7715) GCFR plenum shield design: exit shield experiment.** Muckenthaler, F.J.; Hull, J.L.; Manning, J.J. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 73p. NTIS, PC A04/MF A01.

This report describes the integral flux, energy spectra, and dose rate measurements made for the Exit Shield Experiment at the Oak Ridge National Laboratory Tower Shielding Facility as part of the Gas Cooled Fast Breeder Reactor program. The source was the same mockup of fuel pins used in the previous Grid Plate Shield Experiment. Two mockups of the upper axial shield were studied: one with seven subassemblies prototypic of that portion of the Exit Shield without a control rod, and another that was representative of the shield region with a control rod. The experiment was performed to provide verification of: the shield design methods, the shield effectiveness of a prototypic mockup, the analytical ability to calculate streaming effects in the presence of a control rod, and the source term bias factors for the upper plenum.

22041 **(WAPD-TM—1385) Summary of the thermal evaluation of LWBR (LWBR Development Program).** Lerner, S.; McWilliams, K.D.; Stout, J.W.; Turner, J.R. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Mar 1980. Contract AC11-76PN00014. 78p. NTIS, PC A09/MF A01.

This report describes the thermal evaluation of the core for the Shippingport Light Water Breeder Reactor. This core contains unique thermal-hydraulic features such as (1) close rod-to-rod proximity, (2) an open-lattice array of fuel rods with two different diameters and rod-to-rod spacings in the same flow region, (3) triplate orifices located at both the entrance and exit of fuel modules and (4) a hydraulically-balanced movable-fuel system coupled with (5) axial-and-radial fuel zoning for reactivity control. Performance studies used reactor thermal principles such as the hot-and-nominal channel concept and related nuclear/engineering design allowances. These were applied to models of three-dimensional rodded arrays comprising the core fuel regions.

22042 **(WAPD-TM—1386) Summary of the hydraulic evaluation of LWBR (LWBR development program).** Stout, J.W.; Lerner, S.; McWilliams, K.D.; Turner, J.R. (eds.). (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Apr 1981. Contract AC11-76PN00014. 98p. NTIS, PC A05/MF A01.

The principal hydraulic performance features of the Light Water Breeder Reactor are summarized in this report. The calcula-

tional models and procedures used for prediction of reactor flow and pressure distributions under steady-state and transient operating conditions are described. Likewise, the analysis models for evaluation of the static and dynamic performance characteristics of the hydraulically-balanced and hydraulically-buffered movable-fuel reactivity-control system are outlined. An extensive test program was conducted for qualification of the subject LWBR hydraulic evaluation models. The projected LWBR hydraulic performance is shown to fulfill design objectives and functional requirements.

## 2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

*REFER ALSO TO CITATION(S) 22273*

22043 **(LA—8797-PR) Energy technology. Progress report, October-December 1980.** Breslow, M. (ed.). (Los Alamos National Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 89p. NTIS, PC A05/MF A01.

A separate abstract was prepared for each of the 8 sections of the report for the Energy Data Base. (RCK)

22044 (LA—8797-PR, pp 33-53) **Space power advanced reactor (SPAR).** Apr 1981. NTIS, PC A05/MF A01.

In Energy technology. Progress report, October-December 1980.

Progress is reported in the Space Power Advanced Reactor (SPAR) program with continuing optimization studies having identified additional potential weight savings in the shield and in the reflector. Design and experimental effort on heat pipes has shifted to the artery wick design with initial fabrication having produced arteries welded to simulated distribution wick structures. Preliminary data on thermoelectric materials indicate significant improvements in performance by increasing the levels of boron doping.

## 2107 Regulation And Licensing

22045 **(NE-E—15-2NB-T(Rev.)(1-81)) Class 1 nuclear components (supplement to ASME Boiler and Pressure Vessel Code, Section III, Subsections NCA and NB).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Jan 1981. 37p. Nuclear Standards Management Center, Oak Ridge, TN.

This standard supplements the rules for the construction of nuclear components that are covered by Subsections NCA and NB of the 1980 Edition of the ASME Boiler and Pressure Vessel Code (the Code), Section III. When this standard is invoked or referenced, the applicable subsections of Section III of the Code are also invoked or referenced. The user is responsible for obtaining and applying the edition and revisions of this standard that supplement the edition and Addenda of the Code that are in legal effect at the time of use.

## 2108 Economics

22046 **(DOE/ET/34013—T1) Evaluation and demonstration of methods for improved nuclear-fuel utilization. First semi-annual progress report, inception to June 30, 1980.** Decher, U. (Combustion Engineering, Inc., Windsor, CT (USA); Arkansas Power and Light Co., Little Rock (USA)). Oct 1980. Contract AC02-79ET34013. 51p. (CEND—384). NTIS, PC A04/MF A01.

The purpose of this program is to improve fuel utilization through more efficient fuel management and an increase in fuel burnup. A demonstration of these improvements in uranium utilization is planned for the Arkansas Nuclear One Unit 2 (ANO-2) reactor located near Russellville, Arkansas. This reactor is a 2815 MWT Pressurized Water Reactor (PWR) owned and operated by Arkansas Power and Light. It is the first Combustion Engineering unit to utilize 16 x 16 fuel. More efficient fuel management will be achieved through implementation of a low leakage concept called SAVFUEL (Shimmed and Very Flexible Uranium Element Loading). Burnup will be increased as much as possible for the current fuel design. It should be possible to increase batch-average discharge exposure to about 43 GWD/T. In parallel, advanced fuel will be designed and tested which eventually may allow the batch-average discharge exposure to be increased to 53 GWD/T.

## 2109 Process Heat Reactors

22047 **(DOE/ET/35202—T1(Vol.1)) Pebble Bed Reactor Plant screening evaluation. Volume 1. Overall plant and reactor system.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Nov 1979. Contract AC02-77ET35202. 473p. NTIS, PC A20/MF A01.

This report consists of three volumes which describe the design concepts and screening evaluation for a 3000 MW/sub t/ Pebble Bed Reactor Multiplex Plant (PBR-MX). The Multiplex plant produces both electricity and transportable chemical energy via the thermochemical pipeline (TCP). The evaluation was limited to a direct cycle plant which has the steam generators and steam reformers in the primary circuit. Volume 1 reports the overall plant and reactor system. Core scoping studies were performed which evaluated the effects of annular and cyclindrical core configurations, radial blanket zones, burnup, and ball heavy metal loadings. The reactor system, including the PCRV, was investigated for both the annular and cylindrical core configurations.

22048 **(DOE/SF/02034—T14) Domain of applicability for HTGR molten salt energy transport and storage system.** Neill, J.M. (Advanced Energy Concepts, San Diego, CA (USA)). Apr 1981. Contract AC03-78SF02034. 117p. NTIS, PC A06/MF A01.

The objectives of the work are to investigate the applicability of the transport of energy from a high temperature gas cooled reactor (HTGR) by means of molten salt. The following specific activities were to be addressed in the investigation: review available literature on energy transport systems; identify those factors pertinent to defining an economic and technically feasible domain of applicability of an HTGR/molten salt energy transport system with respect to key parameters such as plant size, necessary attendant systems, and energy transport distance; and identify and discuss critical issues relative to HTGR/molten salt energy transport system.

22049 **(GA-A—16239) HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980.** (General Atomic Co., San Diego, CA (USA)). Apr 1981. Contract AT03-76SF70046. 107p. NTIS, PC A06/MF A01.

This report shows that the high-temperature gas-cooled reactor (HTGR) integrates favorably into present petrochemical and primary metal process industries, heavy oil recovery, and future shale oil recovery and synfuel processes. The technical fit of the HTGR into these processes is excellent, since it can supply the required quantity and high quality of steam without fossil superheating. Also, cogeneration economics appear especially attractive compared to alternative coal-fired steam generation. Further progress is reported on optimization of HTGR safety through incorporation of additional engineered safety features.

22050 **(GA-A—16262) Special applications of gas-cooled reactors.** Peinado, C.O. (General Atomic Co., San Diego, CA (USA)). Feb 1981. Contract AT03-76SF70046. 8p. (CONF-810606—31). NTIS, PC A02/MF A01.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The HTGR technology has been demonstrated by Peach Bottom, Fort St. Vrain, and AVR. Another member of the GCR family is the GCFR. Energy requirements for process heat applications of the HTGR high-temperature nuclear heat source are tabulated. 2 tables. (DLC)

# 22 NUCLEAR REACTOR TECHNOLOGY

*REFER ALSO TO CITATION(S) 22023*

## 2202 Components And Accessories

**22051 (DOE/OR/13511—T1) Development of automated welding process for field fabrication of thick walled pressure vessels. Second quarterly report, FY 1981.** Schneider, U.A. (Westinghouse Electric Corp., Tampa, FL (USA). Nuclear Equipment Div.). 1981. Contract AC05-78ET13511. 6p. NTIS, PC A02/MF A01.

Progress is reported on Task I (review of welding processes), Task II (laboratory adaptation of the GTAW-HW narrow groove process to the vertical and horizontal welds), Task III (8-in. field demonstration/qualification welds in vertical and horizontal positions), and Task IV (welding procedure handbook). (DLC)

**22052** (LA—8797-PR, pp 55-58) **Structural mechanics.** Apr 1981. NTIS, PC A05/MF A01.

In Energy technology. Progress report, October-December 1980.

In the Structural Mechanics programs, progress on the Containment Buckling program has been highlighted by a theory that explains the scatter-in-buckling strength of a penetrated and reinforced cylindrical shell subjected to axial load for fabricated shells. In the Category I Structures program, an experimental progress plan has been written, and the dynamic behavior of a highly-damped, two degree-of-freedom system has been determined. A survey of current analytical methods that handle generalized damping was written. Work on thermal stress analysis of a Fort St. Vrain core support block is summarized.

**22053 Fluid forces on rods vibrating in finite length annular regions.** Mulcahy, T.M. (Argonne Natl Lab, Ill). *Journal of Applied Mechanics ;* **47**: No. 2, 234-240(Jun 1980).

Approximate expressions for the fluid forces acting on a central, rigid rod translating periodically in a finite length annular region of confined fluid are derived from the Navier-Stokes equations for a range of geometric and fluid parameters where viscous damping is significant. Based on the derived forces, lumped added mass, and linear dashpot modeling of an annular gap support typically found in nuclear reactors is employed to predict the fundamental frequency and modal damping of a single beam. 12 refs.

## 2203 Fuel Elements

**22054 (DP-MS—80-120) Gamma-ray monitor for plutonium uniformity in fuel tubes.** Winn, W.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 17p. (CONF-810647—1). NTIS, PC A02/MF A01.

From Conference on X-and gamma-ray sources and applications; Ann Arbor, MI, USA (10 Jun 1981).

Plutonium fuel tubes must be examined for abnormal $PuO_2$ densities. A fuel-gamma densitometer (FGD) was developed to measure the $PuO_2$ content within 3.2-mm-diameter areas. The FGD measurement of hot spot densities is an extension of the usual gamma-scanner application of verifying fuel uniformity within a few percent.

**22055 Oxygen getter coatings for fission reactor fuel pins.** Johnson, C.E.; Fee, D.C. (Argonne National Lab., IL (USA)). *Thin Solid Films ;* **73**: No. 1, 168(3 Nov 1980).

From International conference on metallurgical coatings; San Diego, CA, USA (21 - 25 Apr 1980).

**22056 Examination of LWR irradiated fuel assemblies using simple ion chamber techniques.** Lee, D.M.; Phillips, J.R.; Hsue, S.T.; Kaieda, K.; Halbig, J.K.; Medina, E.G.; Hatcher, C.R. (Los Alamos Scientific Lab., NM (USA)). *Nuclear Instruments amp Methods ;* **176**: No. 3, 583-590(15 Oct 1980).

The application of ion chambers and proportional chambers to the nondestructive examination of irradiated LWR fuel assemblies is discussed. Axial activity profile measurements are compared with the gamma-ray profiles obtained from a germanium detector. A discussion of the use of these simple devices as a complementary technique to the more complicated gamma spectroscopy is given as well as the feasibility of using these devices in a stand-alone mode for consistency checks on the burnups of irradiated LWR fuel assemblies. Emphasis is placed on the simplicity, accuracy, and time-saving aspects of these devices.

## 2205 Environmental Aspects

*REFER ALSO TO CITATION(S) 22081, 22604, 22605, 22607*

**22057 (DOE/PN/00293—T1) 1980 annual radiological environmental report. Volume 2.** (Duquesne Light Co., Shippingport, PA (USA)). 1980. Contract AC11-76PN00292. 119p. NTIS, PC A06/MF A01.

This report describes the Radiological Environmental Monitoring Program conducted during 1980 in the vicinity of the Beaver Valley Power Station and the Shippingport Atomic Power Station. The Radiological Environmental Program consists of on-site sampling of water and gaseous effluents and off-site monitoring of water, air, river sediments, soils, food pathway samples, and radiation levels in the vicinity of the site. This report discusses the results of this monitoring during 1980. The environmental program outlined in the Beaver Valley Power Station Technical Specifications was followed throughout 1980. There were no radioactive liquid effluents released from the Shippingport Atomic Power Station since radioactive liquids are processed and re-cycled within the plant systems. The results of this environmental monitoring program show that Shippingport Atomic Power Station and Beaver Valley Power Station operations have not adversely affected the surrounding environment.

## 2206 Research, Test, And Experimental Reactors

*REFER ALSO TO CITATION(S) 21717*

**22058 (DOE/ER—10727) Ohio State University reactor sharing program. Progress report, September 1, 1980-April 30, 1981.** (Ohio State Univ., Columbus (USA)). 1981. Contract FG02-80ER10727. 12p. NTIS, PC A02/MF A01.

The utilization of the OSURR and GRSS by colleges and universities is summarized. Two student laboratory exercises were developed during this period and are included: control rod calibration and approach to critical. (DLC)

**22059 (HEDL-SA—2044) Shield-verification survey of a large hot cell at the FFTF.** Prevo, P.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 1980. Contract AC14-76FF02170. 6p. (CONF-800735—3). NTIS, PC A02/MF A01.

From Healthy Physics Society summer school; Seattle, WA, USA (14 Jul 1980).

This paper describes a radiation shield verification survey of a large hot cell at the Fast Flux Test Facility (FFTF). The following aspects of the shield test are discussed: description of the FFTF; description of the hot cell; the test procedures; radiation protection, and the test results.

**22060 (HEDL-SA—2275-FP) Generic methods for design of small-bore pipe supports.** Clark, G.L.; LaSalle, F.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 15 Jan 1981. Contract AC14-76FF02170. 9p. (CONF-810625—11). NTIS, PC A02/MF A01.

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

Large numbers of supports for small-bore, low-temperature pipe are utilized in nuclear power plants. These supports often must meet ASME code and project seismic design requirements. Detailed analysis for each support is time consuming and costly. This paper describes some economical generic methods developed to design and qualify supports for two-inch and smaller pipe operating at temperatures less than 300°F (185°C), on the Fast Flux Test Facility. Use of standard designs, standard support spacing tables, anchor bolt and baseplate considerations, and field qualification methods are discussed.

**22061 (HEDL-SA—2278-FP) Thermowell flow-induced vibrations measured in laboratory and FFTF plant piping.** Bartholf, L.W. (Westinghouse Hanford Co., Richland, WA (USA)). 14 Jan 1980. Contract AC14-76FF02170. 24p. (CONF-810625—12). NTIS, PC A02/MF A01.

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

This paper describes the various laboratory and field tests conducted to assure that flow-induced vibrations do not exist in the piping thermowells of the Fast Flux Test Facility. FFTF thermowells are subjected to a wide range of flowing sodium velocities during testing and operation. Early design work indicated a need to provide special attention to thermowell response in the drag direction at the higher sodium flow rates associated with FFTF testing. The results of this study provide some additional insight into response characteristics of a tube in liquid cross flow with emphasis on motion in the drag direction.

**22062 (SAND—81-0749C) Radiation environment behind CdO loaded polyethylene conversion material exposed to a fast burst reactor.** Luera, T.F.; Meason, J.L. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810707—2). NTIS, PC A02/MF A01.

From IEEE conference on nuclear science and space radiation; Seattle, WA, USA (21 Jul 1981).

The free-field hardness parameter for an FBR may be used for experiments behind thick cadmium-loaded polyethylene shields. LINAC calibrations of PIN diodes can be used directly in the photon environment produced by these shields. $CaF_2$:Mn TLD's should be exposed in 2 mm thick aluminum equilibrium shields in this environment.

**22063 Studies of thermal-hydraulic phenomena in EBR-II.** Singer, R.M.; Betten, P.R.; Dean, E.M.; Gilette, J.L.; Mohr, D.; Sullivan, J.E.; Tokar, J.V. (Argonne National Lab., IL (USA). EBR-II Project). *Nuclear Engineering and Design ;* **62**: No. 1-3, 219-232(Dec 1980).

An experimental and theoretical program has been undertaken during the past several years with the objective of developing a well-documented understanding of steady-state and transient thermal-hydraulic behavior in EBR-II. The results of this effort have provided reactor designers and system modelers with needed integral-type demonstrations of important phenomena. This paper will discuss the particular problems of steady-state and transient hot channel peaking factors and plant operational characteristics impact upon natural circulation dynamics. Direct in-core experimental measurements have demonstrated that factors used for the prediction of peak coolant temperature rises at normal rated plant conditions may not be conservative due to pin-bundle distortions or inlet flow maldistributions, while those applied during loss-of-flow transients are most likely overconservative due to inter- and intrasubassembly phenomena. The importance of somewhat controllable parameters such as the sequence of primary and secondary pump trips and reactor scram, primary pump rundown times, and nominal operational power-to-flow ratio upon the dynamics of the transition from forced to natural convective flow are also presented.

**22064 Integrated quality status and inventory tracking system for fftf driver fuel pins.** Gottschalk, G.P. (Westinghouse Hanford Co, Richland, Wash). *National Bureau of Standards (U.S.). Special Publication ;* 313-323(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

An integrated system for quality status and inventory tracking of Fast Flux Test Facility (FFTF) driver fuel pins has been developed. Automated fuel pin identification systems, a distributed computer network, and a data base are used to implement the tracking system. 2 refs.

## 2207 Plutonium And Isotope Production Reactors

**22065 (ORNL/TM—7819) High flux isotope reactor quarterly report, July, August, and September of 1980.** Corbett, B.L.; Poteet, K.H. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01.

Routine reactor operation with three end-of-cycle shutdowns and one unscheduled shutdown resulted in an on-stream time of 94.3% for the quarter.

## 2208 Propulsion Reactors

*REFER ALSO TO CITATION(S) 22273*

## 2209 Reactor Safety

*REFER ALSO TO CITATION(S) 21619, 22860*

**22066 (ANL/TMC—80-3) Fast reactor safety program. Progress report, January-March 1980.** (Argonne National Lab., IL (USA)). May 1980. Contract W-31-109-ENG-38. 162p. NTIS, PC A08/MF A01.

The goal of the DOE LMFBR Safety Program is to provide a technology base fully responsive to safety considerations in the design, evaluation, licensing, and economic optimization of LMFBRs for electrical power generation. A strategy is presented that divides safety technology development into seven program elements, which have been used as the basis for the Work Breakdown Structure (WBS) for the Program. These elements include four lines of assurance (LOAs) involving core-related safety considerations, an element supporting non-core-related plant safety considerations, a safety R and D integration element, and an element for the development of test facilities and equipment to be used in Program experiments: LOA-1 (prevent accidents); LOA-2 (limit core damage); LOA-3 (maintain containment integrity); LOA-4 (attenuate radiological consequences); plant considerations; R and D integration; and facility development.

**22067** (CONF-791016—, pp 62-70) **Evaluation of ECC bypass data with a nonlinear constrained MLE technique.** Bishop, T.A.; Collier, R.P.; Kurth, R.E. (Battelle Columbus Labs., OH). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

Recently, Battelle's Columbus Laboratories have been involved in scale-model tests of emergency core cooling (ECC) systems for hypothesized loss-of-coolant accidents in pressurized water reactors (PWR). These tests are intended to increase our understanding of ECC bypass, which can occur when steam flow from the reactor core causes the emergency coolant to bypass the core and flow directly to the break. One objective of these experiments is the development of a correlation which relates the flow rate of water penetrating to the core to the steam flow rate. This correlation is derived from data obtained from a 2/15 scale model PWR at various ECC water injection rates, subcoolings, pressures, and steam flows. The general form of the correlation being studied is a modification of the correlation first proposed by Wallis. The correlation model is inherently nonlinear and implicit in form, and the model variables are all subject to error. Therefore, the usual nonlinear analysis techniques are inappropriate. A nonlinear constrained maximum-likelihood-estimation technique has been used to obtain estimates of the model parameters, and a Battelle-developed code, NLINMLE, has been used to analyze the data. The application of this technique is illustrated by sample calculations of estimates of the model parameters and their associated confidence intervals for selected experimental data sets. 5 figures, 7 tables.

**22068** (CONF-791016—, pp 71-81) **Nuclear fuel rod stored-energy uncertainty analysis: a study of error propagation in complicated models.** Olsen, A.R.; Cunningham, M.E. (Pacific Northwest Lab., Richland, WA). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

With the increasing sophistication and use of computer codes in the nuclear industry, there is a growing awareness of the need to identify and quantify the uncertainties of these codes. In any effort to model physical mechanisms, the results obtained from the model are subject to some degree of uncertainty. This uncertainty has two primary sources. First, there is uncertainty in the model's representation of reality. Second, there is an uncertainty in the input data required by the model. If individual models are combined into a predictive sequence, the uncertainties from an individual model will propagate through the sequence and add to the uncertainty of results later obtained. Nuclear fuel rod stored-energy models, characterized as a combination of numerous submodels, exemplify models so affected. Each submodel depends on output from previous calculations and may involve iterative interdependent submodel calculations for the solution. The iterative nature of the model and the cost of running the model severely limit the uncertainty analysis procedures. An approach for uncertainty analysis under these conditions was designed for the particular case of stored-energy models. It is assumed that the complicated model is correct, that a simplified model based on physical considerations can be designed to approximate the complicated model, and that linear error propagation techniques can be used on the simplified model.

22069 (CONF-791016—, pp 171-176) **Statistics and risk analysis: getting the acts together.** Moore, R.H. (Nuclear Regulatory Commission, Washington, DC). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

Purpose of this discussion is to provide a metaphorical fresnel lens/prism through which we can focus, examine, and juxtapose the various issues and interfaces and interferences between the two disciplines that are the subjects of this workshop: statistics and risk analysis.

22070 (CONF-791016—, pp 178-186) **Some notable probability and statistics problems encountered in risk analysis applications.** Vesely, W.E. (Nuclear Regulatory Commission, Washington, DC). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

A variety of probability and statistics problems arise when an attempt is made to quantify nuclear power plant risks and to use the risk results in decision making. Some of the more notable problems include (1) measures of uncertainty to use, (2) the way dependent failure probabilities are to be quantified, (3) believability of fault tree/event tree modeling, (4) the handling of subjective data, (5) whether absolute or relative probability evaluations are more believable, (6) Bayesian vs classical approaches, and (7) the way to use risk results and their uncertainties in decision making. These seven problems are addressed; research projects being conducted are described, and some worthwhile, additional studies are proposed.

22071 **(CONF-810406—4) Some factors affecting the metering of subcooled water with a choked venturi.** Fincke, J.R.; Collins, D.R. (Idaho National Engineering Lab., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 14p. NTIS, PC A02/MF A01.

From 27. international instrumentation symposium; Indianapolis, IN, USA (27 Apr 1981).

A series of experiments was performed to characterize the subcooled choking process in a convergent-divergent nozzle with a constant-area throat. The experiments were conducted in a low-pressure flow loop capable of a maximum water flow rate of 5.5 L/s with a pressure head of 300 kPa. The pressure and temperature upstream of the nozzle in the flow loop were adjusted between 90 and 300 kPa and 53 and 96°C, respectively. The variables measured in this study of critical flow phenomena were the flow rate, upstream pressure and temperature, and the axial wall pressure profiles in the nozzle. Critical mass flow rate data were acquired along five isotherms as a function of stagnation pressure. Factors affecting metering performance are examined.

22072 **(CONF-810553—1) Sodium natural convection testing in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility.** Wantland, J.L.; Ribando, R.J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01.

From Specialists' meeting on natural convection decay heat removal; Grenoble, France (20 May 1981).

A comparison is made between experimental data and analytical results for a single-phase natural convection test in an experimental sodium loop. The test was conducted in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility, an engineering-scale high temperature sodium loop at the Oak Ridge National Laboratory (ORNL), used for thermal-hydraulic testing of simulated Liquid Metal Fast Breeder Reactor (LMFBR) subassemblies at normal and off-normal operating conditions. Electrical heating in the 19-pin assembly during the test was typical of decay heat levels. The test chosen for analysis in this paper was one of seven natural convection runs conducted in the facility. In this test the bypass line was open to simulate a parallel heated assembly and the test was begun with a pump coastdown from a small initial forced flow.

22073 **(CONF-810625—15) Comparison of LMFBR piping response obtained using response spectrum and time history methods.** Hulbert, G.M. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Apr 1981. Contract AC15-76CL02395. 18p. NTIS, PC A02/MF A01.

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

The dynamic response to a seismic event is calculated for a piping system using a response spectrum analysis method and two time history analysis methods. The results from the analytical methods are compared to identify causes for the differences between the sets of analytical results. Comparative methods are also presented which help to gain confidence in the accuracy of the analytical methods in predicting piping system structure response during seismic events.

22074 **(EGG-M—00881) Two-phase velocity and density in finite pipes by intrusive and nonintrusive instrumentation.** Chen, T.H.; Kondic, N.N.; Kehler, P.; Solbrig, C.W. (EG and G Idaho, Inc., Idaho Falls (USA); Argonne National Lab., IL (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1981. Contract AC07-76ID01570. 34p. (CONF-810406—6). NTIS, PC A03/MF A01.

From 27. international instrumentation symposium; Indianapolis, IN, USA (27 Apr 1981).

As part of the search for two-phase flow measurement standards, an experimental study was conducted to compare several promising two-phase instruments capabilities to measure nitrogen-water flow rates, velocities and densities at high pressure (5.5 MPa, 800 psia). These studies were conducted in the Full Area Steady-State Test (FAST) loop of the Idaho National Engineering Laboratory. Two-phase quantities in large diameter finite length pipes (in the vicinity of bends) were measured by two nonintrusive means, (1) Pulsed Neutron Activation (PNA) and (2) the Gamma Beam Attenuation densitometer, and by three intrusive devices, (1) Drag-disc Turbine Transducer rake (DTT rake), (2) a traversing turbine, and (3) by a full flow turbine. Pipes of this large size (14 inch schedule 160 pipe; 28.4 cm ID) size are used in the Loss-of-Fluid Test (LOFT) experimental reactor. The measured results indicated pronounced finite-flow-length effects, as well as an agreement between instruments used. The PNA technique showed promise as a standard method for two-phase flow measurements. The nonintrusive methods produced accurate density and velocity values indicating that completely nonintrusive techniques can be used to measure mass flow.

22075 (GEND—002, pp D.1-D.28) **Containment description and radionuclear status.** Hopkins, W. Oct 1980. NTIS, PC A22/MF A01.

From Facility decontamination technology workshop; Hershey, PA, USA (27 Nov 1979).

An assessment is being made of the Three Mile Island-2 reactor for planned re-entry and assessment of the radioactivity status and the physical status of the containment. Scans were made of the

penetrations. Gamma and beta dose rates are given at all elevations. 16 figures. (DLC)

22076 **(GEND—007) Three Mile Island Unit-2 core status summary: a basis for tool development for reactor disassembly and defueling.** Croucher, D.W. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1981. Contract AC07-76ID01570. 73p. NTIS, PC A03/MF A01.

The accident at Three Mile Island Unit-2 (TMI-2) on March 28, 1979 caused extensive damage to the core. A variety of analyses were performed using three general approaches to determine the extent of core damage. First, thermal-hydraulic events were reconstructed using available data, thermal-hydraulic principles, and computer analyses. Second, determinations of the hydrogen generated yielded estimates of the amount of zircaloy oxidized and embrittled. Third, the type and quantity of fission products released during the accident were used to estimate the location of core damage and the fuel temperatures which were achieved. Uncertainties exist in each type of determination due to the equivocal nature of the data. This paper reviews and summarizes the core damage assessments which have been made, identifies the minimum and maximum bounds of damage, and establishes a reference description for the current status of the core.

22077 **(HEDL-SA—2244-FP) Application of software engineering to development of reactor-safety codes.** Wilburn, N.P.; Niccoli, L.G. (Hanford Engineering Development Lab., Richland, WA (USA)). Nov 1980. Contract AC14-76FF02170. 18p. (CONF-810415—9). NTIS, PC A02/MF A01.

From ANS/ENS joint topical meeting on mathematical methods in nuclear engineering; Munich, F.R. Germany (27 Apr 1981).

As a result of the drastically increasing cost of software and the lack of an engineering approach, the technology of Software Engineering is being developed. Software Engineering provides an answer to the increasing cost of developing and maintaining software. It has been applied extensively in the business and aerospace communities and is just now being applied to the development of scientific software and, in particular, to the development of reactor safety codes at HEDL.

22078 **(HEDL-SA—2244-S) Application of software to development of reactor-safety codes.** Wilburn, N.P.; Niccoli, L.G. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1980. Contract AC14-76FF02170. 6p. (CONF-810415—10). NTIS, PC A02/MF A01.

From ANS/ENS joint topical meeting on mathematical methods in nuclear engineering; Munich, F.R. Germany (27 Apr 1981).

Over the past two-and-a-half decades, the application of new techniques has reduced hardware cost for digital computer systems and increased computational speed by several orders of magnitude. A corresponding cost reduction in business and scientific software development has not occurred. The same situation is seen for software developed to model the thermohydraulic behavior of nuclear systems under hypothetical accident situations. For all cases this is particularly noted when costs over the total software life cycle are considered. A solution to this dilemma for reactor safety code systems has been demonstrated by applying the software engineering techniques which have been developed over the course of the last few years in the aerospace and business communities. These techniques have been applied recently with a great deal of success in four major projects at the Hanford Engineering Development Laboratory (HEDL): 1) a rewrite of a major safety code (MELT); 2) development of a new code system (CONACS) for description of the response of LMFBR containment to hypothetical accidents, and 3) development of two new modules for reactor safety analysis.

22079 (LA—8797-PR, pp 71-83) **Nuclear criticality experiments and safety.** Apr 1981. NTIS, PC A05/MF A01.

In Energy technology. Progress report, October-December 1980.

Progress in Nuclear Criticality Experiments and Safety is reported with the completion of experiments to evaluate criticality accident alarm detections and personnel dosimeters and the compilation of preliminary results. The Godiva IV detector collimation structures are being modified in preparation for neutron multiplication measurement in the next proof-of-principle experiment. Intrinsic radiation measurements of a fueled Tomahawk missile have been started using the W80-0 InRad unit.

22080 **(LA-UR—81-317) Numerical simulation for two-phase jet problem.** Lee, W.H.; Shah, V.L. (Los Alamos Scientific Lab., NM (USA); Argonne National Lab., IL (USA)). 1981. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01.

A computer program TWOP was developed for obtaining the numerical solutions of three-dimensional, transient, two-phase flow system with nonequilibrium and nonhomogeneous conditions. TWOP employs two-fluid model and a set of the conservation equations formulated by Harlow and Amsden along with their Implicit Multi-Field (IMF) numerical technique that allows all degrees of couplings between the two fields. We have further extended the procedure of Harlow and Amsden by incorporating the implicit couplings of phase transition and interfacial heat transfer terms in the energy equations. Numerical results of two tested problems are presented to demonstrate the capabilities of the TWOP code. The first problem is the separation of vapor and liquid, showing that the code can handle the computational difficulties such as liquid packing and sharp interface phenomena. The second problem is the high pressure two-phase jet impinged on vertical plate, demonstrating the important role of the interfacial mass and momentum exchange.

22081 **(ORAU/IEA—81-4(M)) Learning function in nuclear reactor operation and its implications for siting policy.** Roberts, P.C.; Burwell, C.C. (Oak Ridge Associated Universities, Inc., TN (USA). Inst. for Energy Analysis). May 1981. Contract AC05-76OR00033. 58p. NTIS, PC A04/MF A01.

The annual frequency of Licensee Events Reports (LERs) is used to measure the learning that takes place in reactor operations. Learning curve theory is found to apply to the separate sets of reporting frequencies associated with pressurized water reactors and boiling water reactors. The method of analysis is then used to discover whether learning is enhanced at multireactor sites and for utilities operating several sites. Although no pattern is observed for owners of several sites, a clear learning benefit accrues to multireactor sites compared to single-reactor sites. The authors use the learning index derived from the analyses and conclude that if all future reactors are placed at sites already in operation with one or more reactors, the total probability for accident (as measured by LER reporting frequencies) will actually decrease even as the total number of reactors increases. This finding funishes additional evidence in support of the existing-site policy advocated by the Institute for Energy Analysis.

22082 **(UCRL—15345) Some hydrogen-control considerations for ice-condenser nuclear plants.** Hubbard, H.W.; Hammond, R.P.; Zivi, S.M. (R and D Associates, Marina del Rey, CA (USA)). Feb 1981. Contract W-7405-ENG-48. 29p. NTIS, PC A03/MF A01.

The proposal of the Tennessee Valley Authority (TVA) for coping with the problem of accident generated hydrogen gas in its Sequoyah ice-condenser plant was to put in place glow-plug igniters so that any hydrogen that is evolved during an accident could be burnt before accumulating into a dangerously large mass. Since it was desired to install these igniters in the Sequoyah and other plants as quickly as possible, the NRC asked the Lawrence Livermore National Laboratory (LLNL) to carry out some experiments on these igniters to delineate the region of their applicability.

22083 **(UCRL—85707) Method for chug classification.** McCauley, E.W.; Weaver, H.J.; Altenbach, T.J. (Lawrence Livermore National Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 14p. (CONF-810643—1). NTIS, PC A02/MF A01.

From 1. international specialists meeting on BWR-pressure suppression containment technology; Geesthacht, F.R. Germany (1 Jun 1981).

A method is presented which classifies the late time condensation phenomena of chugging as it occurs in pressure suppression

tests. The method uses a five (5) character letter code which describes both the spectral (frequency) and temporal characteristics of a chug event. 8 figures.

22084 **Heat transfer in vertical countercurrent steam-water flooding flows.** Liu, J.S.K.; Collier, R.P. (Battelle, Columbus Lab, Ohio). pp 123-129 of Basic mechanisms in two-phase flow and heat transfer (symposium), 1980. Rothe, P.H.; Lahey, R.T. Jr. (eds.). New York, NY; American Society of Mechanical Engineers (1980).

From ASME winter annual meeting; Chicago, IL, USA (16 Nov 1980).

Condensation heat transfer to a falling liquid film in countercurrent steam-water flooding flow has been investigated experimentally. All experimental data were correlated with a single correlation which may be used to infer condensation heat transfer to a turbulent liquid film in countercurrent steam-water flooding flows within the present data range. 11 refs.

# 25 ENERGY STORAGE

*REFER ALSO TO CITATION(S) 22128, 22129, 22130, 22131, 22132, 22137*

## 2501 Magnetic

22085 **Force and inductance calculations for pulsed energy storage shielded magnets.** Eyssa, Y.M.; Boom, R.W.; Shintoni, T.; Masuda, M. (Univ of Wis, Madison). pp 169-173 of Cryogenic processes and equipment in energy systems conference, 1980. Toscano, W.M.; Longsworth, R.C.; Zimmermann, F.J.; Gottzmann, C.F. (eds.). New York, NY; American Society of Mechanical Engineers (1980).

From Cryogenic processes and equipment conference; San Francisco, CA, USA (19 Aug 1980).

The authors report about a new concept for pulsed energy storage magnets. A shielding normal coil enclosing a superconducting magnet is used to eliminate ac losses at liquid helium temperature. The magnet shield design is described in detail. Tables to calculate inductance of shielding dipoles are presented. 6 refs.

22086 **Superconducting magnetic energy storage applications and benefits for electric utility power systems.** Turner, R.D. (Los Alamos Sci Lab, NM). *Annual UMR-DNR ;* 448-457(1979). (CONF-791069—). Rolla, MO, USA (16 Oct 1979).

A Superconducting Magnetic Energy Storage (SMES) system is an integration of a superconducting solenoid, its dewar, and liquid helium refrigerator with an ac-dc converter and the necessary controls. Small SMES units are being designed for dynamic stability applications on electric power systems for use when negatively damped system operating conditions are encountered. 8 refs.

## 2505 Flywheels

*REFER ALSO TO CITATION(S) 21762*

22087 **(UCRL—84347) Safety of isotropic flywheels.** Schwartz, M.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Apr 1981. Contract W-7405-ENG-48. 11p. (CONF-810373—1). NTIS, PC A02/MF A01.

From 5. international conference on fracture; Cannes, France (29 Mar 1981).

A probabilistic safety criterion for isotropic flywheel rotors is established based on the tolerated noncontainment failure rates of commercial aircraft turbojet engine rotors. A technique is developed combining reliability with fracture mechanics, and a sample calculation provided, to show the energy-storage levels that isotropic flywheel rotors could achieve within the constraints of this safety criterion.

## 2506 Thermal

*REFER ALSO TO CITATION(S) 21931, 21953*

22088 **(ORNL/TM—7779) Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981.** Martin, J.F.; Olszewski, M.; McGill, R.N.; Tomlinson, J.J. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 96p. NTIS, PC A05/MF A01.

Progress in the Oak Ridge National Laboratory (ORNL) Thermal Energy Storage (TES) Program is reported for the period March 1980 through February 1981. The ORNL effort constitutes one element in the Office of Advanced Conservation Technologies of the Department of Energy program to develop TES systems to facilitate conservation and use of renewable energy sources. The program consists of two components; the first is development of sensible and latent heat storage technologies to meet the single goal of reduction in oil and gas consumption for residential and space conditioning. In this component, three specific application elements are addressed: (1) utility load management, (2) solar energy, and (3) conservation. The second component is development of TES technology for industrial applications. In this component, two application elements are addressed: (1) TES for in-plant energy utilization and (2) TES for external utilization, primarily district heating. All programs (both completed and ongoing) are summarized, and their relationships to the specific implementation plan are given. The Industrial Applications section was added to and integrated into the TES program this year.

22089 **(PNL—3746) Seasonal thermal energy storage program. Progress report, January 1980-December 1980.** Minor, J.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 183p. NTIS, PC A09/MF A01.

The objectives of the Seasonal Thermal Energy Storage (STES) Program is to demonstrate the economic storage and retrieval of energy on a seasonal basis, using heat or cold available from waste sources or other sources during a surplus period to reduce peak period demand, reduce electric utilities peaking problems, and contribute to the establishment of favorable economics for district heating and cooling systems for commercialization of the technology. Aquifers, ponds, earth, and lakes have potential for seasonal storage. The initial thrust of the STES Program is toward utilization of ground-water systems (aquifers) for thermal energy storage. Program plans for meeting these objectives, the development of demonstration programs, and progress in assessing the technical, economic, legal, and environmental impacts of thermal energy storage are described. (LCL)

## 2509 Batteries

*REFER ALSO TO CITATION(S) 21813*

22090 **(LBL—12102) Electrochemical studies of the film formation on lithium in propylene carbonate solutions under open circuit conditions.** Geronov, Y.; Schwager, F.; Muller, R.H. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 58p. NTIS, PC A04/MF A01.

The nature of protective surface layers formed on lithium in propylene carbonate solutions of $LiClO_4$ and $LiAsF_6$ at open circuit has been investigated by electrochemical pulse measurements and other techniques. The results are consistent with the fast formation of a compact thin layer of $Li_2O$ by reaction with residual water. This layer acts as a solid ionic conductor. Slow corrosion processes produce a thicker porous overlayer.

22091 **(LBL—12445) Failure modes of Na-beta alumina.** De Jonghe, L.C.; Feldman, L.; Buechele, A. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 6p. (CONF-810566—2). NTIS, PC A02/MF A01.

From International conference on fast ionic transport in solids; Gatlinburg, TN, USA (18 May 1981).

Sodium-beta and beta alumina solid electrolytes may, under certain conditions, degrade when used in sodium/sulfur cells. Deg-

radation of sodium-beta aluminas can take two forms: Mode I and Mode II. Mode I is the well-documented electro-mechanical propagation of a preexisting microcrack in the surface of the electrolyte. The critical electrode current densities, j/sub crit/, were determined below 100°C using acoustic emission detection during electrolysis. The temperature dependence and magnitudes of j indicate that the applied voltage is an important factor. Mode II, a degradation involving internal sodium formation is briefly reviewed.

22092 **(LBL—12514) Applied battery and electrochemical research program report for fiscal year 1980.** Cairns, E.; DeJonghe, L.; Evans, J.; McLarnon, F.; Muller, R.; Newman, J.; Ross, P.; Tobias, C. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 135p. NTIS, PC A07/MF A01.

The Exploratory Battery R and D area provides for the study of new electrochemical couples, or of new approaches to known battery systems. High temperature systems under investigation include Ca/molten salt/$FeS_2$, Li/LiI-$Al_2O_3$/$TiS_2$, and Na/$\beta''$-$Al_2O_3$/$SCl_4$-NaCl-$AlCl_3$. Ambient temperature systems being studied are Li/$So_2$/C and Zn/NaOH/$Fe(CN)_6$. New electrode/electrolyte formulations for Zn/KOH/NiOOH and Li/organic electrolyte/$TiS_2$ cells are being investigated, and a status study of ambient temperature secondary lithium batteries was conducted. Projects grouped in the Engineering-Science Research area include morphological and optical studies of battery electrodes in Pb/$H_2SO_4$/$PbO_2$, Zn/KOH/NiOOH, and metal/air cells; and a thermal management study of the high-temperature Li/molten salt/FeS Battery. Improvements in alkaline (Zn/NiOOH and Fe/NiOOH) battery performance are being sought. Materials Research seeks to identify, characterize, and improve the materials and components to be used in batteries and electrochemical processes. Basic investigations have led to the discovery of a novel all-solid electrode structure for possible use as negative electrodes in molten-salt cells. New ternary lithium-transition metal oxides have been identified as possible electrode reactants for use in similar systems. Projects aimed at developing improved separators for high-temperature Na/S and Li/S cells are focusing on such materials as $\beta''$-alumina, NASICON, conducting glasses, and novel superionic conductors. New polymeric separators are being studied for use in ambient-temperature Li/$TiS_2$ cells, and composition profiles in molten-salt electrolytes are being analyzed. Brief summaries of the separate research projects are presented. (WHK)

22093 **(SAND—81-7115C) Recent progress on Exxon's circulating zinc bromine battery system.** Bellows, R.J. (Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.). 1981. Contract AC04-76DP00789. 19p. (CONF-810642—4). NTIS, PC A02/MF A01.

From 4. DOE battery and electrochemical contractor's conference; Washington, DC, USA (2 Jun 1981).

The design, performance, and factory cost of Exxon's circulating zinc bromine batteries are described. The Exxon system has demonstrated stable performance in scale-ups to 3- and 10-kWh sub-modules. Cost studies based on recently demonstrated extrusion and injection molding techniques, have shown that this battery, with plastic electrodes, bipolar stacks, $Br_2$ complexation, and circulating electrolytes, could be produced (20 kWh units, 100,000 units/year) at a factory cost of $28/kWh (excluding R.O.I., and various indirect overheads).

22094 **(SAND—81-7116C) Recent technology improvements in Exxon's circulating zinc-bromine battery system.** Bellows, R.J. (Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.). 1981. Contract AC04-76DP00789. 23p. (CONF-810642—1). NTIS, PC A02/MF A01.

From 4. DOE battery and electrochemical contractor's conference; Washington, DC, USA (2 Jun 1981).

Recent electrode and electrolyte performance on 500 wH and 3 kWh units indicates that Exxon's circulating zinc-bromine battery in 20 kWh designs will be capable of high energy density (65 to 70 wH/kg), and turn-around efficiency (65 to 70%). This performance, coupled with recent factory cost projections of $28/kWh (exclusive of R.O.I. and various indirect overheads), makes zinc/bromine an attractive advanced battery candidate for not only photovoltaic, but also electric vehicle and bulk energy storage applications. Recent technical developments in this program may be generally useful in other circulating electrolyte systems.

22095 **(SAND—81-7119C) Development of a totally maintenance-free, deep-discharge lead-acid battery for photovoltaic applications.** Szymborski, J. (Gould, Inc., Rolling Meadows, IL (USA). Gould Labs.). 1981. Contract AC04-76DP00789. 7p. (CONF-810642—2). NTIS, PC A02/MF A01.

From 4. DOE battery and electrochemical contractor's conference; Washington, DC, USA (2 Jun 1981).

Progress in the development, design, fabrication and testing of 6-volt, 100 ampere-hour totally maintenance-free lead-acid batteries for photovoltaic applications is reported. Totally maintenance-free sealed operation is achieved by designing the cells so that only oxygen is generated on charge. The electrodes in the cell are separated by a highly porous material which allows the oxygen access to the negative electrode where it is reduced. There is no loss of gas from the cell and the oxygen recombination rate is high enough to efficiently reduce the oxygen at internal pressures slightly above atmospheric. This allows inexpensive prismatic components and containers to be used which are easily adaptable to a wide range of ampere-hour sizes. Cells and batteries have been fabricated, tested and delivered to Sandia Laboratories. Uniform initial capacity of $>100$ Ah has been achieved. The cells have a low pressure vent which has operated reliably over a wide range of temperatures and after many thousands of vent-reseal cycles. Satisfactory capacity retention has been demonstrated on cells subjected to 2 deep discharge-recharge cycles per day. The cells can be recharged in less than 8 h with negligible pressure build-up. Cycle life tests, and tests to determine the tolerance of the cells to open circuit stand at various states of charge and over the operating range of temperatures are in progress.

# 29 ENERGY PLANNING AND POLICY

*REFER ALSO TO CITATION(S) 22967*

22096 (CONF-8003114—, pp 537-546) **Energy, entropy, and information.** Fowler, A.H. (Oak Ridge Y-12 Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The link of entropy with energy and information is discussed. The historical development of energy is covered by characterizing the industrial revolution, the scientific revolution, and the information revolution. The information revolution stimulated the study of information theory which has led to a better understanding of entropy and its key role in linking energy and information. The equation for entropy as expressed in thermodynamics is compared with that used information theory. The separation of uranium is used to illustrate energy efficiency. (MCW)

22097 **(DOE/PE/03784—T1) Energy in transition 1985 to 2010: overview. Final report.** (National Research Council, Washington, DC (USA). Committee on Nuclear and Alternative Energy Systems). 1979. Contract AC01-76PE03784. 127p. NTIS, PC A07/MF A01.

This study by the Committee on Nuclear and Alternative Energy Systems (CONAES) examines in detail all aspects of the nations energy situation. Some technical and economic observation that decision makers may find useful as they develop energy policy in the larger context of the future of society are offered. The observations focusing on the prime importance of energy conservation; the critical near-term problem of fluid fuel supply; the desirability of a balanced combination of coal and nuclear fission as the only large-scale intermediate-term options for electricity generation; the need to keep the breeder option open; and the importance of investing now in research and development to ensure the availability of a strong range of new energy options sustainable over the long term are discussed in detail. (MCW)

## 2901 Energy Analysis And Modeling

*REFER ALSO TO CITATION(S) 22165, 22205, 22227, 22257*

**22098** (CONF-791016—, pp 146-153) **Strategies for model evaluation.** Gruhl, J. (Massachusetts Inst. of Technology, Cambridge). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

A short discussion about the importance of procedures for evaluating the accuracy of complex computerized policy models, a description of a large number of alternative methods for model assessment, and the selection of cost-effective evaluative strategies are presented. Because the assessment activities are likely to be severely constrained by available funding, time, and manpower resources, there are potentially great dividends that will result from the careful consideration and selection of assessment techniques. Strategies for assessment should be chosen with particular attention directed toward assessment objectives and model characteristics.

**22099** **(ORNL/CSD/TM—141) Operating experience with LEAP from the perspective of the computing applications analyst.** Ford, W.E. III; Horwedel, J.E.; McAdoo, J.W.; Alsmiller, R.G. Jr.; Toney, B.C. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 192p. NTIS, PC E07/$3.50.

Includes 2 sheets of 48x reduction microfiche.

The Long-Term Energy Analysis Program (LEAP), which was used for the energy price-quantity projections in the 1978 Annual Report to Congress (ARC '78) and used in an ORNL research program to develop and demonstrate a procedure for evaluating energy-economic modeling computer codes and the important results derived therefrom, is discussed. The LEAP system used in the ORNL research, the mechanics of executing LEAP, and the personnel skills required to execute the system are described. In addition, a LEAP sample problem, subroutine hierarchical flowcharts, and input tables for the ARC '78 energy-economic model are included. Results of a study to test the capability of the LEAP system used in the ORNL research to reproduce the ARC '78 results credited to LEAP are presented.

## 2902 Economics And Sociology

*REFER ALSO TO CITATION(S) 21542, 21588, 21993, 22099, 22123, 22166, 22602*

**22100** **(ANL/CNSV—19) Construction-employment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities.** Santini, D.J.; Wernette, D.R. (Argonne National Lab., IL (USA)). Jul 1980. Contract W-31-109-ENG-38. 54p. NTIS, PC A04/MF A01.

Construction employment opportunities are compared for four oil-replacing technologies providing equivalent space-heating services to the core areas of 13 major northeastern and midwestern cities. The four technologies are: cogeneration district heating, coal gasification, coal liquefaction and electrification (coal-fired power plant). It is observed that the district-heating option places a higher percentage of its capital stock within the center city. It also requires lower occupational skills for its construction than the other three alternatives. In view of the lower average educational level of minorities and their concentration in urban areas, substantially more minority employment should occur if district heating is implemented. This alternative also will provide employment opportunities for unemployed nonminority construction laborers and contribute indirectly to the improvement of inner-city neighborhoods where many unemployed construction laborers live.

**22101** **Projected effects of energy policies on agricultural water use and irrigation.** Heady, E.O.; English, B.C.; Dvoskin, D. (Iowa State Univ). *Water Resources Bulletin ;* **16**: No. 6, 1012-1019(Dec 1980).

A national and interregional programing model was used to project the impacts of alternative energy policies and prices on agricultural production, land use, and irrigation. The alternatives analyzed include natural gas deregulation, natural gas curtailment, doubled energy prices, and tripled energy prices. Natural gas curtailment would have the largest impact on nitrogen use on irrigated land. Increased energy prices would increase the use of surface water for irrigation and reduce the use of groundwater through higher pumping costs. Water supply prices increase under each alternative.

**22102** **Analysis of fully distributed cost pricing in regulated industries.** Braeutigam, R.R. Contract EY-76-G-03-1305. *Bell Journal of Economics ;* **11**: No. 1, 182-196(Spr 1980).

This paper examines the economic consequences of allocating common costs by (1) gross revenues, (2) directly attributable costs, and (3) relative output levels (such as ton-miles) to determine fully distributed cost (FDC) prices for regulated firms. The analysis characterizes FDC tariffs by examining the nature of the economic inefficiency associated with the rules and explains how opportunities for entry by unregulated firms might change if Ramsey optimal pricing were used instead of FDC pricing. 12 references, 2 figures, 1 table.

**22103** **Public opinion about energy.** Farhar, B.C.; Unseld, C.T.; Vories, R.; Crews, R. (Solar Energy Research Inst., Golden, CO). *Annual Review of Energy ;* **5**: 141-172(1980).

This summary of findings from hundreds of studies is devoted to an interpretation of public preferences as parameters for policymaking. Gaps in existing knowledge about what people say and what they do about energy are also identified. Research gaps exist for energy conservation, solar energy, oil as an energy source, coal, environmental effects, and energy trade-offs. Overall, most studies on energy opinion are atheoretical, which limits their usefulness for policy purposes and perpetuates research gaps. From the few theoretical analyses that have been done, the following hypotheses for further research are suggested: (1) that willingness to conserve energy, adopt solar energy, and accept other alternatives, such as nuclear power or gasoline rationing, are a function of belief in an energy crisis; (2) that belief in an energy crisis is a function of (a) attribution of the energy problem to the declining availability of fossil fuels rather than to sociopolitical and economic causes; (b) negative energy-related impacts experienced or anticipated; (c) awareness of energy facts and issues; (d) environmental concern; and (e) exposure to credible information sources with high levels of factual knowledge; and (3) that adoption of energy-conserving practices and of solar energy is a function of (a) their perceived effectiveness; (b) concern about any risks involved; (c) assessment of the relative advantage of doing so; (d) awareness and knowledge; (e) a favorable position toward it; (f) the availability of the necessary information and equipment; and (g) coming to a decision to act. 150 references, 3 figures, 5 tables.

## 2903 Environment, Health, And Safety

*REFER ALSO TO CITATION(S) 22109, 22122, 22141, 22533, 22535, 22545, 22557*

**22104** **(DOE/EV/10454—T1) Greater Caribbean Energy and Environment Future. Ad hoc working group report, Key Biscayne, Florida, October 26-28, 1980.** Thorhaug, A. (ed.). (Florida International Univ., Miami (USA)). 1980. Contract FG01-80EV10454. 20p. NTIS, PC A02/MF A01.

This report of Workshop I (presented in outline form) by the Greater Caribbean Energy and Environment Foundation begin an intensive focus on the energy problems of the Caribbean. The process by which environmental assessments by tropical experts can be successfully integrated into energy decisions is by: (1) international loan institutions requiring or strongly recommending excellent assessments; (2) engineering awareness of total effects of energy projects; (3) governmental environmental consciousness-raising with regard to natural resource value and potential inadvertent and unnecessary resource losses during energy development; and (4) media participation. Section headings in the outline are: preamble; introduction; research tasks: today and twenty years hence; needed research, demonstration and information dissemination projects to get knowledge about Caribbean energy-environment used; summary; recommendations; generalized conclusions; and background literature. (JGB)

## 2904 Natural Resources

*REFER ALSO TO CITATION(S) 21538, 22124*

## 2905 Research, Development, Demonstration, And Commercialization

*REFER ALSO TO CITATION(S) 21522, 21566, 22134, 22137*

22105 (CONF-791016—, pp 94-96) **Energy R and D in the private sector.** Sullo, P. (Rensselaer Polytechnic Inst., Troy, NY); Wilkinson, J.; Nason, H.K. Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

The purpose of this study is to supply the Department of Energy (DOE) with information pertinent to the formulation of realistic national energy research and development (R and D) policies and to facilitate cooperation between government and business in the development and commercialization of new and improved energy technologies. The study gathered information on the amount of energy-related R and D private companies are doing, the types of energy related R and D they report, and their perceptions about approximate areas for government support.

22106 (EPRI-P—1726-SR, pp 305-380) **Energy Analysis and Environment Division.** Jan 1981. NTIS, PC A21/MF A01.

In 1981-1985 research and development program plan: program descriptions.

The three basic objectives of this research division are: (1) to provide information and methods to be used in determining the Electric Power Research Institute's research and development (R and D) priorities; (2) to encourage the use of this information and methods by utilities in their cperating and planning decisions; and (3) to make the information and methods available for national policy decisions through individual utilities, trade associations, or directly to local and Federal agencies. Division activities will focus on fuel supply and costs, electricity demand, the consequences of electric system expansion, power-generating options, emission effects, waste-recovery options, effluent treatments and disposal, hazard testing, and decision evaluation. The research plans and budgets of seven research programs to meet these objectives are detailed. 24 figures.

22107 **(WAOENG—80-17) Current energy research and development in Washington State, 1980.** Alexander, G. (ed.). (Washington State Energy Office, Olympia (USA)). Sep 1980. 69p. Washington State Energy Office, Olympia, WA.

This is the second annual inventory of energy research and development programs within the State of Washington and is intended to disseminate new energy data and information to researchers, policy makers and citizens. The programs are arranged under the following headings: fossil fuels, renewable energy sources, nuclear energy and energy conservation. (LCL)

22108 **Hawaii Natural Energy Institute annual report, 1980.** Manoa, Hawaii; Univ. of Hawaii (1980). 57p. (NP—1902437).

The background, the 1980 activities, and the future of programs on geothermal energy, ocean energy, biomass energy, wind energy, direct solar energy in Hawaii are summarized. Progress is also reported on development of submarine cables, electric-powered vehicles, and hydroelectric power. Background, the 1980 activities, and the future of social, environmental, legal, financial, and economic issues dealing with development of renewable energy sources are briefly described. (MCW)

## 2906 Nuclear Energy

*REFER ALSO TO CITATION(S) 21651, 22081, 22556, 22910*

## 2908 Waste Heat Utilization

*REFER ALSO TO CITATION(S) 21821, 21840, 22192, 22236, 22238, 22241, 22247, 22249, 22255*

22109 **Environmental trade-offs with the adoption of cogeneration technologies.** Burness, H.S. (Univ. of New Mexico, Albuquerque); Cummings, R.G.; Paik, I. *Journal of Environmental Economics and Management ;* **8**: No. 1, 45-58(Mar 1981).

Current US Department of Energy strategies for meeting energy crises include efforts to promote the cogeneration of energy. One cogeneration allocation is the energy-saving potential involved in the cogeneration of process heat and electricity. However, cogeneration technologies often face an unfavorable economic climate due to increasingly stringent environmental standards. This paper investigates the policy options that might encourage the adoption of cogeneration technologies and still provide for an adequate level of environmental protection. That social welfare may well be best served by combinations of policy instruments related to some form of subsidy and adjustments in emission standards should certanly be of interest to those concerned with the assessment of public policy in the energy field. With improved data, one would certainly expect a characterization of the policy space, to be nonlinear, in which case trade-offs between charges in emission standards and the use of subsidies will become much more subtle. The refinement of estimates for returns to cogeneration - which more broadly reflect such things as taxes, tax credits institutional - regulatory constraints and/or costs - will provide more meaningful assessments of ranges of specific policy options related to impacting the socio-economic environment in which the cogeneration technology is viewed in the private sector. 7 references, 6 figures, 3 tables.

22110 **Overview of waste-heat-utilization techniques.** Olszewski, M. (Oak Ridge Natl Lab, Tenn). *Proceedings of the American Power Conference ;* **41**: 793-799(1979). (CONF-790443—).

From American power conference; Chicago, IL, USA (23 Apr 1979).

Utilization of low-grade heat rejected to the atmosphere by power plants to heat greenhouses and to breed fish or aquatic plant life for food or fuel (aquaculture or mariculture when practiced in salt water) in the United States and abroad is described. 23 refs.

## 2910 Conservation

*REFER ALSO TO CITATION(S) 21732, 22164, 22166, 22170, 22171, 22172, 22173, 22174, 22191, 22195, 22196, 22197, 22204, 22208, 22212, 22220, 22222, 22223, 22226, 22230, 22231, 22232, 22233, 22234, 22235, 22247, 22248, 22250, 22251, 22252, 22253, 22258, 22557*

22111 **Guide to the adoption of energy conservation retrofit ordinances.** Sacramento, CA; Solarcal Council ([nd]). 71p. (NP—1902510).

The guide provides answers to the following: why adoption at the local level of energy conservation retrofit ordinances; what is an energy audit; and who performs the audit? Guidance is also provided on existing ordinances and programs, cost analysis, tax credit, and financing. Measures for constructing and ordinance and preparing for public hearings are presented. Additional issues and answers dealing with conservation ordinances are included. (MCW)

22112 **(CONF-810140—1) Link between traditional planning and energy management.** Schweitzer, M. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01.

From Community energy planning conference; Gatlinburg, TN, USA (20 Jan 1981).

In simple terms, community energy planning is the process of envisioning a desired future state of energy supply and consumption for a local area and designing the appropriate measures to implement that future. While energy planning can be distinguished from other specialized concerns, such as housng or transportation planning, there are also major similarities which bind all these ele-

ments together. These similarities and differences are discussed. Community-level energy planning represents a natural extension of the comprehensive planning process. As the comprehensive plan has grown in the past to reflect new subjects of public concern such as environmental quality and economic development, so it can evolve further to address society's growing interest in energy use. Because the general purpose, process, and implementation devices associated with energy planning tie it closely with the comprehensive planning process as currently practiced, incorporating energy issues into the comprehensive plan should be a relatively simple matter.

22113 (CONF-8003114—, pp 19-26) **DOE's in-house energy management program.** D'Amico, V.J. (Dept. of Energy, Oak Ridge, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The program that DOE is implementing from now until 1985 with respect to energy usage is described. The long-term goal called for a 20% reduction in energy usage by 1985 over the 1975 base year and the short-term goal called for a 5% reduction for the 12-month period beginning April 1, 1979, as compared to the preceding 12 months. Also included in the directive for Federal facilities was the requirement to reduce automotive fuels by 10% and to set thermostats at not moe than 65°F for the heating season and not lower than 80°F for the cooling season. The Department also has a goal of reducing the natural gas and oil consumption in DOE facilities by 50% by 1985. Some data are presented representing progress on accomplishing the set goals. It is noted that the most readily available, economic source of additional energy is conservation. (MCW)

22114 (CONF-8003114—, pp 29-44) **Do's and don't in energy conservation design.** Dubin, F.S. (Dubin-Mindell-Bloome Associates, New York, NY). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

That energy conservation is part of a broader energy management program is stressed. It involves a system approach - each system must be examined separately. Problems with computer usage are noted. Computers should be used as tools in the design process to look at building subsystems before they are put together into a plan. It is recommended that everyone be involved in the energy management program. Some measures to consider along with energy measurement include reducing the load; using the proper energy source; the effect of the system that was selected on equipment used and equipment life; and heat recovery. The application and results of some of the measures are discussed for specific buildings. (MCW)

22115 (CONF-8003114—, pp 147-153) **Guidelines and input requirements for submitting energy management projects to DOE.** Shelton, R.L. (Oak Ridge Gaseous Diffusion Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The method for obtaining from DOE the funds to conduct research on energy conservation projects is described. Energy management projects are separated into two categories according to funding levels, as line item projects greater than $1,500,000 and retrofit projects less than $1,500,000. Information is provided on how to fill out such applications. The organizational framework that has developed for initiating and submitting candidate projects is reviewed. Unique aspects of the Energy Management Program are indicated. (MCW)

22116 (CONF-8003114—, pp 155-168) **Life cycle cost analysis.** Pierce, F.E. (Tennessee Valley Authority, Knoxville, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

An overview of life cycle cost analysis performed by the Environmental Control Department at Union Carbide is presented. The basic parameters involved in life cycle cost analysis and the computer program used to do the actual analysis are discussed. The general procedure for evaluating energy conservation projects is described. (MCW)

22117 **(DOE/BP—32) Energy management workbook for local governments. Workbook 1: electrical energy.** (Puget Sound Council of Governments (USA); USDOE Bonneville Power Administration, Portland, OR). Feb 1981. 91p. NTIS, PC A05/MF A01.

Descriptions are presented for 20 major categories of energy actions providing background information needed for communities to implement energy management programs and explaining where financial and technical help may be available. Chapter 1 provides background on the energy problem, discusses Federal, state and local roles, and outlines the planning process. Chapter 2 is a list of 20 questions to help identify a range of potential actions that could become part of the energy management plan. Chapter 3 will help evaluate each of the twenty potential activities, and chapters 4 and 5 discuss implementing and monitoring the energy management plan. (MCW)

22118 **Municipal Energy Management Program (MEMP).** Stillwater, OK; Oklahoma State University (1980). 189p. Oklahoma Department of Energy, Oklahoma City, OK.

A guide to aid the cities of Oklahoma to save energy is presented and includes information on municipal operations and buildings and their functions. Details are provided on organizing the energy management program, auditing buildings, implementing the no/low cost energy conservation actions; deciding on best initial cost retrofit action and implementations; and tracking energy and dollar savings and publicizing. The appendix contains supplemental information, a glossary, and a bibliography. (MCW)

## 2920 Supply, Demand, And Forecasting

*REFER ALSO TO CITATION(S) 21584, 21586, 22103, 22140, 22167*

22119 **(DOE/TIC—1022409) Strategy papers prepared by the Implementation Group of the New England Energy Congress.** (New England Energy Congress, Somerville, MA (USA)). Jul 1980. 155p. NTIS, PC A08/MF A01.

Over the nine months prior to release of this report, a 55-member task force worked at developing strategies and program initiatives to implement the New England Energy Congress' Blueprint for Energy Action, released in June 1979. Prepared for the bipartisan, six-state New England Congressional Caucus, the Blueprint was the result of a first in the national effort to formulate a regional energy plan. Comprised of representatives of eleven constituencies ranging from environmental organizations to industry to state and Federal agencies, the Implementation Group of the Energy Congress divided itself into five working committees: (1) Wood, Solid Waste and Peat, (2) Electric Issues, (3) Conservation, Solar and Low Income, (4) Oil, and (5) Natural Gas, Coal, and Synfuels. Each committee developed strategy papers and program initiatives, which were reviewed by the full Implementation Group, and are presented here. Although the formal deliberations of the Energy Congress are now complete, the goals developed by the group are just beginning to be fulfilled. Initiatives in both the public and private sectors have been put into motion to achieve Energy Congress objectives. A number of recently enacted Federal and state laws directly reflect the group's input.

22120 **(ORNL—5746) Input parameters for LEAP and analysis of the Model 22C data base.** Stewart, L.; Goldstein, M. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 226p. NTIS, PC A11/MF A01.

The input data for the Long-Term Energy Analysis Program (LEAP) employed by EIA for projections of long-term energy supply and demand in the US were studied and additional documentation provided. Particular emphasis has been placed on the LEAP Model 22C input data base, which was used in obtaining the output projections which appear in the 1978 Annual Report to Congress. Definitions, units, associated model parameters, and translation equations are given in detail. Many parameters were set to null values in Model 22C so as to turn off certain complexities in

LEAP; these parameters are listed in Appendix B along with parameters having constant values across all activities. The values of the parameters for each activity are tabulated along with the source upon which each parameter is based - and appropriate comments provided, where available. The structure of the data base is briefly outlined and an attempt made to categorize the parameters according to the methods employed for estimating the numerical values. Due to incomplete documentation and/or lack of specific parameter definitions, few of the input values could be traced and uniquely interpreted using the information provided in the primary and secondary sources. Input parameter choices were noted which led to output projections which are somewhat suspect. Other data problems encountered are summarized. Some of the input data were corrected and a revised base case was constructed. The output projections for this revised case are compared with the Model 22C output for the year 2020, for the Transportation Sector. LEAP could be a very useful tool, especially so in the study of emerging technologies over long-time frames.

22121 **(ORNL/TM—7199) Regional economic and energy consumption implications of the NEP-2 base case scenarios.** Bjornstad, D.J.; Vogt, D.P.; Stuckwish, D.N. (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 69p. NTIS, PC A04/MF A01.

An attempt is made to measure the impact of changes in the national economy on regions of the United States, translated onto a grid of 173 regions, into national employment and energy consumption impacts that result from different prices for imported crude oil. These projections extend to the year 1995. Once calculated, regional economic and energy conditions are examined tabularly and graphically to highlight above and below average inter-temporal change and world oil price-related change. Regions are also classified by initial socioeconomic characteristics to determine if particular types of regions receive systematically different impacts. Although much evidence of systematic change is present at the regional level, the relatively small changes occurring in the national economy do not lead to large regional impacts. This analysis found no disruptive or highly significant regional impacts occurring from the price change assumptions of the scenarios.

22122 **Annual review of energy. Volume 5.** Hollander, J.M.; Simmons, M.K.; Wood, D.O. (eds.). Palo Alto, CA; Annual Reviews Inc. (1980). 440p.

The many continuing efforts around the world to deal with the issues of energy supply, demand, and environmental impact are reviewed. This volume carries reviews of recent developments in solar-photovoltaic technology and inertial-confinement fusion as long-term options. Progress in some important nearer-term energy-supply areas is reviewed by contributions in the fields of battery energy storage and coal clean-up technology. In the area of energy sociology, the interesting and poorly understood topic of public opinion about energy is reviewed. The subject of energy economics is represented by a review of the role of governmental incentives in energy production. Topics related to the environmental aspects of energy technologies include coastal flooding from atmospheric carbon dioxide warming, risks of liquefied natural gas and petroleum gas, and the environmental impacts of renewable energy sources. Continuing the practice of earlier volumes to review the energy perspective of a particular region or country, Volume 5 carries a review of emerging energy technologies in island environments, typified by the case of Hawaii. Finally, the energy problem from the perspective of developing countries is reviewed by two papers, the first on renewable energy resources for developing countries, and the second on the problem of energy for the people of Asia and the Pacific. A separate abstract was prepared for each of the 12 reviews for the Energy Data Base (EDB); all will appear in Energy Abstracts for Policy Analysis (EAPA) and three in Energy Research Abstracts (ERA).

## 2930 Policy, Legislation, And Regulation

*REFER ALSO TO CITATION(S) 22102, 22103, 22119, 22124, 22125, 22212, 22229*

22123 **Energy issues.** O'Leary, J. (Dept. of Energy, Washington, DC). *Materials and Society ;* **5**: No. 1, 1-3(1981).

Mr. O'Leary observes that government regulation in the energy sector has changed in the past decade from a relatively minor to a dominant consideration, above those that are purely economic and technical, in business decisions. The curve of social intervention in what were formerly private decisions will continue to grow. The interpretation of rules by the courts has been more of a problem than the laws themselves. Another problem has been a group which assumed a mission of regulatory delay or whose inexperience in a regulated industry prevented an understanding of the issues. (DCK)

## 2940 Fossil Fuels

*REFER ALSO TO CITATION(S) 21487, 21488, 21522, 21542, 21543, 21544, 21547, 21565, 21566, 21567, 21584, 21586, 21588, 21589, 22005, 22136, 22461, 22723*

22124 **Regulating coal: new approaches for a Reagan administration.** Rollins, H.R. (Dept. of Energy, Washington, DC). *Materials and Society ;* **5**: No. 1, 7-10(1981).

The coal industry will require continued regulation for the first half of the 1980s until coal markets and transport systems are as healthy as those of other fuels. Mrs. Rollins feels that regulators have been handicapped by disallowing those with experience or conflicts-of-interest in the field who are perceived as using the government to gain advantage; having a viewpoint, however, is not dishonest, she notes. The conflict of pro-coal with environmental-protection policies in the 1970s put legislation in competition with administrative goals and put industry in a state of confusion and apprehension. Mrs. Rollins observes that something like the defeated Energy Mobilization Board may be needed to counteract what have been disruptive regulatory policies and to select certain energy sources for regulatory exemptions. Business will be dealing more with regulators who have a management instead of a legal background. They must do a better job of explaining policy and setting priorities. (DCK)

22125 **Regulatory impact an oil development.** Bloom, P. (Dept. of Energy, Washington, DC). *Materials and Society ;* **5**: No. 1, 11-16(1981).

A background review of legislation affecting oil production points out how it was intended to provide production incentives and prevent disincentives against unitization, tertiary recovery, and marginal production. The rules have not had a positive effect, especially for North Slope production, and production trends have not been upward. A study of the largest seven companies shows an accumulative decline rate of 8.2% as compared to a 1.2% decline for the rest of industry. The discrepancy is because the large companies control the largest and oldest fields and not the result of collusion. The Graduated Crude Oil Decontrol Program that will release old and new oil prices upwards is intended to turn the situation around, but the practice of in-fill drilling, tightening space, and using other short-term techniques to bring about a production surge will not have the long-term effect of massive new discoveries and tertiary recovery. (DCK)

22126 **Capturing oil rents with a national excise tax. Summer Institute paper No. 80-3.** Bergstrom, T.C. Cambridge, MA; National Bureau of Economic Research (1980). 24p. (NP—1902615).

In a Hotelling-type model with a costlessly extracted natural resource (such as soil), if a uniform excise tax rate is collected from all consumers, the entire burden of the tax is borne by suppliers. This paper analyzes tax incidence and optimal taxation in a static model and extends the results to the intertemporal case by establishing an isomorphism between the multiperiod and the one-period models. Both cooperative and noncooperative behavior are considered. Currently an optimal tax rate for the US, acting noncooperatively, might be on the order of $0.25 to $0.50 per gallon of gasoline. (DLC)

22127 **Analysis of cumulative crude oil discovery and production.** Uri, N.D. (DOE, Washington, DC). pp 1251-1255 of Proceedings of the annual Pittsburgh conference on model simulation. Pittsburgh, PA; ISA (1979).

From Instrument Society of America, Pittsburgh modeling and simulation conference; Pittsburgh, PA, USA (25 Apr 1979).

Consideration is given to the problem of estimating cumulative reserves and cumulative production of crude oil in the United States. It is first demonstrated that these values depend on technological change and the price of crude oil. The results suggest that approximately 205 billion barrels of oil are ultimately recoverable and producible at a price of /29 per barrel. Of this total, 114 billion barrels have been produced through the end of 1977. 8 refs.

## 2950 Hydrogen And Synthetic Fuels

*REFER ALSO TO CITATION(S) 21725, 22136*

## 2960 Electric Power

*REFER ALSO TO CITATION(S) 21735, 21748, 22004, 22005, 22011, 22017, 22461, 22602*

**22128 (DOE/JPL/955456—1(Vol.1)) Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume I. Final report.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Oct 1980. Contract AI01-79ET29372. 316p. NTIS, PC A14/MF A01.

Dispersed Storage and Generation (DSG) is the term that characterizes the present and future dispersed, relatively small (<30 MW) energy systems, such as solar thermal electric, photovoltaic, wind, fuel cell, storage battery, hydro, and cogeneration, that can help achieve national energy conservation goals and can be dispersed throughout the distribution portion of an electric utility system. A study of trends reveals that the need for DSG monitoring and control equipment by 1990 to 2000 will be great, measured in tens of thousands. Criteria for assessing DSG integration have been defined and indicate that economic and institutional as well as technical and other factors must be included. The principal emphasis in this report is on the functional requirements for DSG monitoring and control in six major categories. Twenty-four functional requirements have been prepared under these six categories and serve to indicate how to integrate the DSGs with the distribution and other portions of the electric utility system. The results indicate that there are no fundamental technical obstacles to prevent the connection of dispersed storage and generation to the distribution system. However, a communication system of some sophistication will be required to integrate the distribution system and the dispersed generation sources for effective control. The large-size span of generators from 10 kW to 30 MW means that a variety of remote monitoring and control may be required. The results show that an increased effort is required to develop demonstration equipment to perform the DSG monitoring and control functions and to acquire experience with this equipment in the utility distribution environment.

**22129 (DOE/JPL/955456—1(Vol.2)) Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume II. Final report, Appendix A: selected DSG technologies and their general control requirements.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Oct 1980. Contract AI01-79ET29372. 170p. NTIS, PC A08/MF A01.

A major aim of the US National Energy Policy, as well as that of the New York State Energy Research and Development Authority, is to conserve energy and to shift from oil to more abundant domestic fuels and renewable energy sources. Dispersed Storage and Generation (DSG) is the term that characterizes the present and future dispersed, relatively small (<30 MW) energy systems, such as solar thermal electric, photovoltaic, wind, fuel cell, storage battery, hydro, and cogeneration, which can help achieve these national energy goals and can be dispersed throughout the distribution portion of an electric utility system. The purpose of this survey and identification of DSG technologies is to present an understanding of the special characteristics of each of these technologies in sufficient detail so that the physical principles of their operation and the internal control of each technology are evident. In this way, a better appreciation can be obtained of the monitoring and control requirements for these DSGs from a remote distribution dispatch center. A consistent approach is being sought for both hardware and software which will handle the monitoring and control necessary to integrate a number of different DSG technologies into a common distribution dispatch network. From this study it appears that the control of each of the DSG technologies is compatible with a supervisory control method of operation that lends itself to remote control from a distribution dispatch center.

**22130 (DOE/JPL/955456—1(Vol.3)) Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume III. Final report, Appendix B: state of the art, trends, and potential growth of selected DSG technologies.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Oct 1980. Contract AI01-79ET29372. 44p. NTIS, PC A03/MF A01.

A major aim of the US National Energy Policy, as well as that of the New York State Energy Research and Development Authority, is to conserve energy and to shift from oil to more abundant domestic fuels and renewable energy sources. Dispersed Storage and Generation (DSG) is the term that characterizes the present and future dispersed, relatively small (<30 MW) energy systems, such as solar thermal electric, photovoltaic, wind, fuel cell, storage battery, hydro, and cogeneration, which can help achieve these national energy goals and can be dispersed throughout the distribution portion of an electric utility system. The purpose of this document is to identify the present status, trends, potential growth for selected DSGs, and implications on DSG monitoring and control. Based on current projections, it appears that DSG electrical energy will comprise only a small portion, from 4 to 10%, of the national total by the end of this century. In general, the growth potential for DSG seems favorable in the long term because of finite fossil energy resources and increasing fuel prices. Recent trends, especially in the institutional and regulatory fields, have favored greater use of DSGs for the future. This study has assimilated the considered estimates and opinions of others, for the DSG markets and the DSG's ability to serve them. So far as possible a cross section of various sources has been included in composite projections.

**22131 (DOE/JPL/955456—1(Vol.4)) Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume IV. Final report, Appendix C: identification from utility visits of present and future approaches to integration of DSG into distribution networks.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Oct 1980. Contract AI01-79ET29372. 72p. NTIS, PC A04/MF A01.

A major aim of the US National Energy Policy, as well as that of the New York State Energy Research and Development Authority, is to conserve energy and to shift from oil to more abundant domestic fuels and renewable energy sources. Dispersed Storage and Generation (DSG) is the term that characterizes the present and future dispersed, relatively small (<30 MW) energy systems, such as solar thermal electric, photovoltaic, wind, fuel cell, storage battery, hydro, and cogeneration, which can help achieve these national energy goals and can be dispersed throughout the distribution portion of an electric utility system. As a result of visits to four utilities concerned with the use of DSG power sources on their distribution networks, some useful impressions of present and future approaches to the integration of DSGs into electrical distribution network have been obtained. A more extensive communications and control network will be developed by utilities for control of such sources for future use. Different approaches to future utility systems with DSG are beginning to take shape. The new DSG sources will be in decentralized locations with some measure of centralized control. The utilities have yet to establish firmly the communication and control means or their organization. For the present, the means for integrating the DSGs and their associated monitoring and control equipment into a unified system have not been decided.

**22132 (DOE/JPL/955456—1(Vol.5)) Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume V. Final report, Appendix D: cost-benefit considerations for providing dispersed storage and generation for electric utilities.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Oct 1980. Contract AI01-79ET29372. 40p. NTIS, PC A03/MF A01.

A major aim of the US National Energy Policy, as well as that of the New York State Energy Research and Development Authority, is to conserve energy and to shift from oil to more abundant domestic fuels and renewable energy sources. Dispersed Storage and Generation (DSG) is the term that characterizes the present and future dispersed, relatively small (<30 MW) energy systems, such as solar thermal electric, photovoltaic, wind, fuel cell, storage battery, hydro, and cogeneration, which can help achieve these national energy goals and can be dispersed throughout the distribution portion of an electric utility system. Cost benefit considerations are extremely important in obtaining the acceptance of dispersed storage and generation by the electric utilities. These considerations may involve somewhat different economic analyses depending on whether the generation is utility, customer, or combined ownership. It will be necessary to get acceptance of more easily understood methods for evaluating the economics of DSG because much of the benefits of DSG may accrue in the generation and transmission portions of the utility system while the costs tend to be centered in the distribution portion of that system. Depending on the rating and availability of the DSG, the monitoring and control portion of the system may be relatively low in cost compared to the value of the energy supplied for DSGs in the 5 MW range and above and relatively high in cost compared to the smaller 10 to 50 kW units. The influence of other factors, such as reliability, capital costs, and other economic measures, can be important to utility and customer alike in judging the costs and benefits of DSGs.

**22133 (DOE/RG/06668—T1) Power plant productivity improvement in New York.** (New York State Dept. of Public Services, Albany (USA)). Mar 1981. Contract AC01-78RG06668. 168p. NTIS, PC A08/MF A01.

The New York Public Service Commission (PSC), under contract with the US Department of Energy (DOE), began a joint program in September 1978 to improve the productivity of coal and nuclear electric generating units in New York State. The project had dual objectives: to ensure that the utilities in New York State have or develop a systematic permanent, cost-effective productivity improvement program based on sound engineering and economic considerations, and to develop a model program for Power Plant Productivity Improvement, which, through DOE, can also be utilized by other regulatory commissions in the country. To accomplish these objectives, the program was organized into the following sequence of activities: compilation and analysis of power plant performance data; evaluation and comparison of utility responses to outage/derating events; power plant productivity improvement project cost-benefit analysis; and evaluation of regulatory procedures and policies for improving productivity. The program that developed for improving the productivity of coal units is substantially different than for nuclear units. Each program is presented, and recommendations are made for activities of both the utilities and regulatory agencies which will promote improved productivity.

**22134 (EPRI-P—1726-SR) 1981-1985 research and development program plan: program descriptions.** (Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1981. 484p. NTIS, PC A21/MF A01.

This program plan is one of three planning documents published annually by the Electric Power Research Institute. The 40 programs described are organized in accordance with the Institute's technical divisions: Coal Combustion Systems, Nuclear Power, Electric Systems, Energy Analysis and Environment, Advanced Power Systems, and Energy Management and Utilization. The EPRI research program focuses on near-term evolutionary improvements of current technologies and on the development of next-generation options. Major emphasis is placed on electricity supply and conservation; minimizing utility financial and revenue requirements; reducing use of foreign oil and gas; coal and nuclear systems; and health and environmental implications. Each program is described in terms of its major specific objectives, importance to the electric-utility industry, motivating issues, technical impediments, anticipated key events and planned expenditures over the next five years. The document, after a brief introductory section, is organized under the six divisions noted above; a separate abstract was prepared for the section of each division.

**22135 (EPRI-P—1726-SR, pp 209-302) Electrical Systems Division.** Jan 1981. NTIS, PC A21/MF A01.

In 1981-1985 research and development program plan: program descriptions.

The EPRI Electrical Systems Division will invest more than 85% of its resources during the 1981-85 period on electric-utility research which will present the industry with new and improved short-term options for decisions concerning system economics, reliability, operations, and the environment. Research authority is shared by power and transmission systems departments. A partial list of successful projects which are now being commercialized is followed by highlights of the major objectives for 1981-85 and detailed plans for research programs on underground transmission, overhead transmission, transmission substations, power system planning and operations, rotating electrical machinery, and distribution. 31 figures.

**22136 (EPRI-P—1726-SR, pp 383-476) Advanced Power Systems Division.** Jan 1981. NTIS, PC A21/MF A01.

In 1981-1985 research and development program plan: program descriptions.

EPRI's Advanced Power System Division research and development programs encompass the analysis and technologies for meeting base, intermediate, and peaking demands. Close coordination is necessary with government and private organizations whose expenditures sometimes exceed those of EPRI. The principal objectives of the Advanced Fossil Power Systems (AFPS) Department are to develop and demonstrate a range of environmentally compatible synthetic fuels and advanced electric power systems based on domestic fossil resources, principally coal; projects to accomplish these objectives are managed under three program areas: clean gaseous fuels, clean liquid and solid fuels, and power generation. The overall objective of the Renewable Resources Systems (RRS) Department is to provide the private utility industry with a technical and economic understanding of the potential of solar, geothermal, and fusion power systems and to selectively develop key technology components or systems; program descriptions for each power system are given. 27 figures.

**22137 (EPRI-P—1726-SR, pp 479-524) Energy Management and Utilization Division.** Jan 1981. NTIS, PC A21/MF A01.

In 1981-1985 research and development program plan: program descriptions.

Research goals of the EPRI Energy Management and Utilization Division are to develop advanced cost-effective systems for power generation, provide systems and equipment that will permit economical energy storage and workable concepts for managing electric loads, and develop technical advances to achieve energy and resource conservation through efficient use of electricity. Specific research programs to achieve these goals are divided into three categories: fuel cells and chemical energy conversion, energy storage, and energy utilization and conservation technology. Details of the subprograms and budgets are given for each category. 15 figures.

**22138 (TVA/OP/PINF—81/2) Power Program Summary. Volume II. Fiscal year ending June 30, 1980.** (Tennessee Valley Authority, Chattanooga (USA)). 1980. 59p. NTIS, PC A04/MF A01.

This is a report of the operations during the fiscal year ending June 30, 1980, of the 110 municipal and 50 cooperative electric systems that distribute TVA power to 2.8 million customers. The areas served by these locally owned distributors include 80,000 square miles in parts of seven states and have a population of well over six million. Data for this report were gathered by TVA from annual reports and other material prepared by each of these 160 distributors. The data is based on the distributors fiscal year ending

June 30, 1980. However, beginning with fiscal year 1977 all Federal agencies have operated on a fiscal year ending September 30. Volume I of the Power Program Summary contains data which reflect the TVA fiscal year ending September 30, 1980 and therefore varies slightly from distributor fiscal year.

**22139 Correcting for truncation bias in the analysis of experiments in time-of-day pricing of electricity.** Aigner, D.J. (Univ. of Southern California, Los Angeles); Hausman, J.A. *Bell Journal of Economics ;* **11**: No. 1, 131-142(Spr 1980).

This paper applies methods for analyzing data from samples that have been chosen by restricting the target population in discernible ways to data from a 1976 experiment in time-of-day pricing of electricity for residential customers in Arizona. It was found that whereas conventional estimation methods lead to the conclusion that the peak price elasticity of demand is larger (in absolute value) than either the corresponding midpeak or offpeak elasticity, once truncation bias is accounted for, the peak elasticity is smaller than the other two. This finding accords with a preliminary analysis of data from Wisconsin, where no such sample truncation was present. 16 references, 1 figure, 4 tables.

## 2980 Consumption And Utilization

*REFER ALSO TO CITATION(S) 22113, 22121, 22178, 22179, 22180, 22181, 22182, 22183, 22184, 22185, 22186, 22187, 22188, 22189, 22190, 22206*

## 2990 Unconventional Sources And Power Generation

*REFER ALSO TO CITATION(S) 21730, 21734, 21736, 21737, 21746, 21750, 21756, 21800, 21806, 21816, 21820, 21821, 21825, 21843, 21862, 21885, 21932, 21954, 21956, 21989, 21990, 22111, 22122, 22136*

**22140 (DOE/CE/56051—3) Ethanol energy yield per gallon and potential petroleum displacement.** (Mueller Associates, Inc., Baltimore, MD (USA)). May 1981. Contract AC05-79CS56051. 27p. NTIS, PC A03/MF A01.

The intent of this document is to convey an understanding of the maximum amount of premium fuels which could be displaced if a serious effort is undertaken in the US to promote the production of ethanol obtained from corn. Agricultural uses of premium fuels are considered, but the usage of premium fuels to process the corn into ethanol and deliver the ethanol to its point of end use is not considered; this is an important qualification since any use of premium fuels to perform these latter tasks will further reduce any potential displacement of petroleum. If the entire respective 1974 and 1975 corn crops had been converted to ethanol for use as Gasohol, then anywhere from about 224,000 to 333,000 barrels per day (3430 to 5100 million gallons per year) of petroleum (equivalent) could have been displaced if no premium fuels were involved in any way in the processing and transportation of ethanol. The USDA has applied a methodology to estimate that current uncultivated lands could produce 17 billion gallons per year of ethanol. Although lacking a link between the quality of these lands and the Farm Production Regions in which they occur, these 17 billion gallons may displace from 97,800 to 444,000 barrels per day (1500 to 6800 million gallons per year) of petroleum (equivalent) exclusive of any premium fuels associated with corn processing and ethanol distribution. Additional study is required to arrive at conclusive values.

**22141 Environmental aspects of renewable energy sources.** Holdren, J.P.; Morris, G.; Mintzer, I. (Univ. of California, Berkeley). *Annual Review of Energy ;* **5**: 241-291(1980).

This review surveys the literature treating environmental characteristics of renewable energy sources. The material drawn on includes (a) some well-known energy-environmental data bases and comparative surveys, which, although generally emphasizing nonrenewable sources, touch on renewables as well; (b) the small number of recent reports whose main focus is environmental comparisons of renewable energy sources with each other and with nonrenewables; (c) comparate surveys of technologic and economic characteristics of renewable sources, which touch incidentally on environmental characteristics; and (d) studies covering individual renewable energy sources or individual environmental issues for a range of sources. This literature is reviewed in four steps, namely; (1) consider what information is required for comprehensive, comparative assessment of the environmental effects of energy alternatives, and evaluate briefly the coverage of the extant literature on renewable sources against this standard; (2) summarize the technical characteristics of the most promising renewable-energy technologies, emphasizing how these characteristics give rise to environmental problems; (3) compare the most-promising renewables to each other and to selected nonrenewables with respect to the main categories of environmental problems, quantitatively where possible; and (4) offer some suggestions concerning implications for energy choices and directions for further work. 198 references, 8 tables.

# 30 DIRECT ENERGY CONVERSION

*REFER ALSO TO CITATION(S) 22137*

## 3001 Mhd Generators

*REFER ALSO TO CITATION(S) 21560*

**22142 (ANL/MHD—80-8) MHD heat and seed recovery technology project. Ninth quarterly report, January-March 1980.** Petrick, M.; Johnson, T.R. (Argonne National Lab., IL (USA)). May 1980. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01.

The MHD Heat and Seed Recovery Technology Project at Argonne National Laboratory is obtaining information for the design and operation of the steam plant downstream of the MHD channel-diffuser, and of the seed regeneration process. The project goal is to supply the engineering data required in the design of components for prototype and demonstration MHD facilities. The primary effort of the HSR Technology Project at Argonne is directed toward experimental investigations of critical problem areas, such as (1) NO/sub x/ behavior in the radiant boiler and secondary combustor; (2) radiant boiler design to meet the multiple requirements of steam generation, NO/sub x/ decomposition, and seed-slag separation; (3) effects of solid or liquid seed deposits on heat transfer and gas flow in the steam and air heaters; (4) formation, growth, and deposition of seed-slag particles; and (5) character of the combustion gas effluents. These investigations are performed primarily in a 2-MW test facility, Argonne MHD Process Engineering Laboratory (AMPEL). Other project activities are related to studies of the thermochemistry of the seed-slag combustion gas system, identification of ceramic and metallic materials for service in the MHD-steam plant, and evaluation of seed regeneration processes. Progress is described.

**22143 (ANL/MHD—81-5) Analysis of flow, gas-particle radiation, and particulate deposition in radiant boilers.** Im, K.H.; Ahluwalia, R.K.; Berry, G.F. (Argonne National Lab., IL (USA)). Apr 1981. Contract W-31-109-ENG-38. 75p. NTIS, PC A04/MF A01.

Flow, heat and mass transfer processes in the radiant boilers of magnetohydynamic power plants are analyzed. Flow field in the radiant boiler is simulated by assuming a uniformly mixed zone to exist in the entrance region, followed by a developing boundary layer region. Heat transfer is presumed to occur by both turbulent convection and radiation. The radiation model includes the simultaneous contribution to heat transfer of carbon dioxide, water vapor, potassium atoms, and slag particles which are allowed to absorb as well as scatter thermal radiation. The absorption coefficients of gaseous species are determined from band correlations and experimental data. The extinction and scattering coefficients of slag particles are computed directly from Mie theory. For computing heat transfer, radiation transport equation is solved on a spectral basis. The complete flow, heat and mass transfer model is used to study the thermal characteristics of the radiant boilers. Impacts of slag-refractory interface temperature on corrosion and erosion of refractory, and of slag layer thickness on plant start-up time are discussed. By presenting the scale-up of heat transfer with refractory thickness and boiler diameter, the factors involved in designing an experimental facility for simulating base load boilers are highlighted. The

temperature history computed from the heat transfer model is used in an extant chemical kinetics code to determine the practical levels to which NO/sub x/ can be decomposed in MHD radiant boilers. Calculations indicate that the EPA specified limit on NO/sub x/ levels can be met in properly designed radiant boilers operating with sub-stoichiometric products of combustion. The potential of the complete model to serve as a strong analytical tool in selecting an optimum geometry for radiant boilers is stressed by proposing an optimization procedure. (WHK)

22144 **(DOE/ET/10780—T1) High magnetic field MHD generator program. Final report, July 1, 1976-December 31, 1979.** Eustis, R.H.; Kruger, C.H.; Mitchner, M.; Self, S.A.; Koester, J.K.; Nakamura, T. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Apr 1980. Contract AC01-76ET10780. 210p. (FE—2341-16). NTIS, PC A10/MF A01.

A theoretical and experimental program was undertaken to investigate MHD channel phenomena which are important at high magnetic fields. The areas studied were inhomogeneity effects, boundary layers, Hall field breakdown and electrode configuration and current concentrations. In addition, a program was undertaken to study steady-state combustion disk and linear channels in an existing 6 Tesla magnet of small dimensions. The structure of the inhomogeneities in the Stanford M-2 was characterized and compared with theoretical results from a linearized perturbation analysis. General agreement was obtained and the analysis was used to compute stability regions for large size generators. The Faraday electrical connection was found to be more stable than the Hall or diagonal wall connections. Boundary layer profile measurements were compared with theoretical calculations with good agreement. Extrapolation of the calculations to pilot scale MHD channels indicates that Hartmann effects are important in the analysis of the sidewall, and Joule heating is important in calculating heat transfer and voltage drops for the electrode wall. Hall field breakdown was shown to occur both in the plasma and through the interelectrode insulator with the insulator breakdown threshold voltage lower than the plasma value. The threshold voltage was shown to depend on the interelectrode gap but was relatively independent of plasma conditions. Experiments were performed at 5.5 Tesla with both disk and linear MHD channels.

22145 **(DOE/ET/15518—3) Key contributions in MHD power generation. Quarterly technical progress report, September 1, 1979-November 30, 1979.** Louis, J.F. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Mar 1980. Contract AC01-79ET15518. 255p. NTIS, PC A12/MF A01.

Separate entries were made in the data base for the four tasks which include: (1) investigation of electrical behavior in the vicinity of electrode and insulating walls; (2) studies of critical performance issues in the development of combustion disk generators; (3) development and testing of electrode modules, including studies of insulator properties; and (4) determination of coal combustion kinetics and ash behavior relevant to two-stage MHD combustors, and investigation of the mixing and flow aerodynamics of a high swirl geometry second stage. (WHK)

22146 (DOE/ET/15518—3, pp 9-69) **Detailed description of technical progress task 1, arcing phenomena in MHD generators.** Mar 1980. NTIS, PC A12/MF A01.

In Key contributions in MHD power generation. Quarterly technical progress report, September 1, 1979-November 30, 1979.

Work carried out under this task includes measurements of simulated slag flow in a glycerin channel; the data indicate that ripples are responsible for essentially all of the mass transport within the slag layer. Surface tension and form drag over the ripples are shown to be the dominant forces controlling the glycerin flow, and non-dimensional correlations of ripple speed, height, separation and width are presented in a form which can be used for estimations of these properties under MHD conditions. Design calculations for laminated electrode configurations for future experiments in the MHD Simulation Facility are discussed; the study emphasizes the need for taking account of the increased heat-flux due to locally high Joule heating in the thermal design of the inter-electrode regions. Other efforts reported include results of tests aimed at improving the present diagnostics in the facility; the initial formulation of a theoretical treatment of slag layer current transport studies is also presented.

22147 (DOE/ET/15518—3, pp 70-89) **Open cycle disk generator program. Task 2.** Mar 1980. NTIS, PC A12/MF A01.

In Key contributions in MHD power generation. Quarterly technical progress report, September 1, 1979-November 30, 1979.

Under this task, the first set of nonuniformities experiments was completed, and the framework for the analysis of the data was established. The nonuniformities, created by cold blades located in the upstream region of a radial flow disk generator, consisted of well-characterized thermal and velocity wakes with strong variations of the plasma properties in the azimuthal direction. A data base for a fixed set of stagnation conditions and test gas mixture ($T_0$ = 2850 K, $p_0$ = 4.0 atm and Ar 80%/$CO_2$ 20% at room temperature) was obtained for ideal Hall coefficients in the range 2-7 and for configurations having 0, 6, 12, and 24 wakes. Experimental Hall parameter reduction curves ($\beta$/sub eff/ versus $\beta$/sub ideal/) were established; the data clearly indicate the monotonic degradation of generator performance for this type of nonuniformity (and orientation) with increasing Hall parameter and number of wakes (rms$\alpha$). The theoretical framework for analysis of the data is discussed, and a preliminary comparison of the voltage data for 24 blades at 3.5 Tesla with two theoretical models shows good agreement between theory and experiment.

22148 (DOE/ET/15518—3, pp 90-110) **Electrode module development and testing. Task 3.** Mar 1980. NTIS, PC A12/MF A01.

In Key contributions in MHD power generation. Quarterly technical progress report, September 1, 1979-November 30, 1979.

Work reported includes modifications to the experimental apparatus to permit more accurate control of the surface composition of sample MHD generator electrodes made from materials in the $LaFeO_3$ - SrFeO/sub 3-$\delta$/ - $SrZrO_3$ system. Considerable attention has been paid to minimizing the possible contamination from Si which has been shown to react with the electrode materials and form surface layers of silicates. Other work, on insulator materials, has focused on obtaining some explanation for the large variations in room temperature breakdown strength observed for numerous specimens of hot pressed silicon nitride. Scanning electron microscopy and other diagnostics have so far failed to yield any reasonable explanation.

22149 **(DOE/ET/15602—T4) MHD air heater technology development. Annual technical progress report, January 1, 1980-December 31, 1980.** (FluiDyne Engineering Corp., Minneapolis, MN (USA)). Mar 1981. Contract AC01-80ET15602. 204p. NTIS, PC A10/MF A01.

Progress on the technology development of the directly-fired high temperature air heater (HTAH) for MHD power plants is described in detail. The objective of task 1 is to continue development of ceramic materials technology for the directly-fired HTAH. The objectives of task 2 are to demonstrate the technical feasibility of operating a directly-fired HTAH (including both the heater matrix and valves), to continue obtaining information on life and corrosion resistance of HTAH materials, and to obtain design information for full-scale studies and future design work. The objectives of task 3 are to begin the identification of HTAH control requirements and control system needs, and to continue full-scale study efforts incorporating updated materials and design information in order to identify development needs for the HTAH development program. (WHK)

22150 **(DOE/ET/15619—T1) Microwave gaseous electrode development. Final report.** Jones, M.S. Jr.; Sathyanarayana, K.; Mallavarpu, R.; Thiagarajan, V. (Reynolds Metals Co., Sheffield, AL (USA). Energy Conversion Div.). 31 Dec 1980. Contract AC01-80ET15619. 68p. (FE—5619-1). NTIS, PC A04/MF A01.

A microwave plasma torch was developed and tested at bench scale using power inputs of up to 400 W at 2.45 GHz. The bench scale tests included: characterization of the plasma torch operating characteristics as gas composition, gas flow rate, and power

input were varied; measuring the effects of magnetic fields on the plasma torch operation; measuring the effects on the plasma torch operation of an aerodynamic flow field past the exit of the torch (cold flow tests); and measurements were made to characterize the plasma gas temperature and electron temperature. Following these tests, the microwave plasma torch was installed in the anode wall of the RMC diagonal conducting wall MHD generator. Hot flow tests were conducted in the channel using unseeded combustion products. These were followed by MHD power generation tests using subsonic and supersonic flows seeded with up to 1.5 w/o potassium and magnetic fields up to 3.8 Tesla. For one series of tests the magnetic field was reversed so that the surface containing the microwave plasma torch operated as a cathode. Following the MHD generator tests, another concept using a microwave slot radiator to produce plasma in the MHD boundary layer was tested at the bench scale. Measurements were made of the parameters necessary to sustain a discharge with the slot radiator open, similar to the microwave plasma torch, with argon flowing through the slots; and with the slots closed with a castable ceramic, the argon flowing past the outside of the slot. The latter tests were extended to a slot configuration appropriate for use in a slagging channel which incorporated water cooling passages in the surface which would be in contact with the MHD channel working fluid. Results are presented and discussed. (WHK)

22151 **(DOE/NASA/10769—16) Performance calculations for 200-1000 MWe MHD/steam power plants.** Staiger, P.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1981. Contract AI01-77ET10769. 11p. (NASA-TM—81775; CONF-810639—1). NTIS, PC A02/MF A01.

From 19. symposium on the engineering aspects of magnetohydrodynamics; Tullahoma, TN, USA (15 Jun 1981).

The effects of MHD generator length, level of oxygen enrichment, and oxygen production power on the performance of MHD/steam power plants ranging from 200 to 1000 MW in electrical output are investigated. The plants considered use oxygen enriched combustion air preheated to 1100°F. Both plants in which the MHD generator is cooled with low temperature and pressure boiler feedwater and plants in which the generator is cooled with high temperature and pressure boiler feedwater are considered. It is shown that for plants using low temperature boiler feedwater for generator cooling the maximum thermodynamic efficiency is obtained with shorter generator and a lower level of oxygen enrichment compared to plants using high temperature boiler feedwater for generator cooling. It is also shown that the generator length at which the maximum plant efficiency occurs increases with power plant size for plants with a generator cooled by low temperature feedwater. Also shown is the relationship of the magnet stored energy requirement to the generator length and the power plant performance. Possible cost/performance tradeoffs between magnet cost and plant performance are indicated.

22152 **(DOE-tr—73) Some aspects of the study of gas-discharge plasma and production of high magnetic fields.** Novitskii, V.G. (ed.). (Department of Energy, Washington, DC (USA)). 1981. Translation of Nekotorye voprosy issledovaniya gazorazryadnoi plazmi i sozdaniya sil'nykh magnitnykh polei; Izdatel'stvo Nauka, Leningrad, USSR, 1970. 181p. NTIS, PC A09/MF A01.

This collection is compiled from the papers presented in the section of MHD generators and superconducting devices at the Institute of Electromechanics Conference held in May 1965. The subjects discussed include three-phase plasmatrons, their operational characteristics, and the nature of the physical processes occurring in the arc chamber. The collection also contains the results of experimental and theoretical research on gas-discharge plasma, conduction phenomena in flowing gaseous plasmas, and energy balance and radiation in the case of gas-discharge plasma. It also considers the stability of arcs, the effect of the transverse magnetic field and gas flow on breakdown voltages, the electrode phenomena and the distribution of current on the electrodes. Results of research on the conditions of electric-arc contraction and the characteristics of a contracted arc are given. The problems associated with the production of high magnetic fields and the use of superconducting materials to this end are discussed. The experience gained in the design and fabrication of superconducting magnets and cryostats is described. The results of design calculations for magnetic systems of the Bitter type are also presented. (WHK)

## 3003 Thermoelectric Generators

22153 **(DOE/ET/32043—T7) Silicon germanium (SiGe) radioisotope thermoelectric generator (RTG) program for space missions. Nineteenth technical progress report, December 1980-January 1981.** (General Electric Co., Philadelphia, PA (USA). Space Div.). 1981. Contract AC01-79ET32043. 53p. NTIS, PC A04/MF A01.

Work accomplished during the reporting period on the DOE Silicon Germanium RTG Program, Contract DE-AC01-79ET-32043 is described. This program consists of the following three tasks: multi-hundred watt RTG for the Galileo probe mission; reestablishment of silicon germanium unicouple capability; and general purpose heat source RTG for the international solar polar and Galileo orbiter missions. Details of program progress for each task, including a milestone schedule and a discussion of current problem areas (if any) are presented.

## 3004 Thermionic Converters

22154 **(DOE/ET/11293—T3) Advanced thermionic energy conversion. Joint highlights and status report, July-September 1979.** (Rasor Associates, Inc., Sunnyvale, CA (USA)). 1979. Contract AC02-76ET11293. 131p. (COO—2263-16). NTIS, PC A07/MF A01.

The DOE portion of the effort is directed primarily toward terrestrial applications of thermionic energy converters suitable for use with fossil fueled heat sources in power plants. The NASA program is directed at establishing the technical feasibility of an advanced, light-weight, long-life thermionic conversion system compatible with a remote nuclear or solar heat source. The principal application foreseen at this time is in nuclear electric propulsion (NEP) missions in the mid-1990's. Significant accomplishments for the DOE program include: (1) successfully operating a thermionic converter using a cold insulator seal (Plexiglass and Viton); (2) completed fabrication and testing of SPC-9, a reference planar converter with smooth molybdenum electrodes; (3) created a shooting type analytical ignited mode converter computer model; (4) projected the operating conditions needed to achieve advanced converter performance with a thick cesium oxide collector; and (5) invented a cellular ceramic heat exchanger for obtaining high radiant heat flux from a hot gas. Accomplishments for the NASA program include: (1) achieved over 3100 hours of operation with the cylindrical converter JPL-5 (STR/STR); (2) provided guidelines for definition of optimum lead characteristics in the JPL NEP computer program; and (3) performed a preliminary NEP optimization study which suggests a 400 kWe system with a specific mass of 26 kg/kWe is possible with present converter performance (V/sub B/ = 2.0). Details are presented. (WHK)

22155 **(DOE/ET/15423—5) Application of microfabrication technology to thermionic energy conversion. Progress report No. 5, August 1, 1980-October 31, 1980.** Brodie, I.; Shepherd, C. (SRI International, Menlo Park, CA (USA). Engineering Sciences Lab.). 14 Nov 1980. Contract AC02-79ET15423. 10p. NTIS, PC A02/MF A01. Order Number DE81024987.

Considerable effort was directed toward the fabrication of a micron-spaced thermionic converter. In the process, a new technique has evolved which appears more promising and has been investigated theoretically. In both techniques, electrodes of similar differential thermal expansions are utilized to prevent shear stresses from disrupting the spacing pillars. The newer technique has additional advantages that simplify the fabrication of the diode structure, thus making it more practical. Progress is described.

**22156 (DOE/ET/15423—6) Application of microfabrication technology to thermionic energy conversion. Progress report No. 6, November 1, 1980-January 31, 1981.** Brodie, I.; Shepherd, C.; Spindt, C.A. (SRI International, Menlo Park, CA (USA). Engineering Sciences Lab.). 9 Mar 1981. Contract AC02-79ET15423. 15p. NTIS, PC A02/MF A01. Order Number DE81024986.

Effort was directed toward the fabrication of a micron-spaced thermionic converter diode. This technique demonstrated that interelectrode spacings down to 1.5 μm could be obtained. Several methods of duplicating the emitter and collector surfaces were also investigated. Two new techniques are proposed; both stem from an earlier idea of using evaporation, photolithography, and etching techniques. These two fabrication methods yielded a one-piece diode structure with a thick-film copper collector, eliminating the need to physically duplicate the electrode surfaces and realign the electrodes. Effort has also been directed toward a more detailed theoretical analysis of micron-spaced thermionic converter performance. Taking into account heat losses through the interelectrode support structure, it is likely that the maximum energy conversion efficiency may be greatest at a spacing somewhat larger than 1 micron (μm), but less than 10 μm.

## 3005 Fuel Cells

*REFER ALSO TO CITATION(S) 21511*

**22157 (DOE/ET/11304—T7) Development of molten-carbonate fuel-cell technology. Technical status report, August-October 1980.** (Energy Research Corp., Danbury, CT (USA) ). 1980. Contract AC02-76ET11304. 45p. NTIS, PC A03/MF A01.

Efforts in the development of mechanically stable anodes with more enduring pore structures are being concentrated at present on the powder/metal alloy fabrication process. One of the new alloy compositions being prepared for electrode production concerns a new 50 at. % nickel-copper powder. Another task in the electrode development area is directed at producing low resistance cathodes. The newly developed fabrication procedure of wet-forming thin nickel powder films from aqueous PVA-binder slurries is showing promising results. The relatively low-cost, standard electrolyte of 50Li/50K cation ratio used at ERC is being re-examined for performance level compared to higher lithium content melts. All other cell components and the tile matrix material used in these tests are of exactly the same type so as to be able to positively identify the electrolyte composition effect. A second pressurized, bench-scale (300 $cm^2$), cell test has been operated successfully showing that under the demanding conditions of 80% utilization with low-Btu fuel, the performance goal of 850 mV at 160 $mA/cm^2$ can be met with 10 atmosphere pressurization. Details are given. (WHK)

**22158 (DOE/ET/11304—T10) High-temperature molten-carbonate fuel cells. Technical progress report, January-March 1979.** (Energy Research Corp., Danbury, CT (USA) ). May 1979. Contract AC02-76ET11304. 110p. NTIS, PC A06/MF A01.

Progress on the design, development, fabrication, performance testing, and modeling of molten carbonate fuel cells is reported. Component development including electrode structures, electrolyte powder, electrolyte tiles, and cell frame and current collectors is described. (WHK)

**22159 (DOE/ET/11305—T8) Thin film battery/fuel cell power generation system. Topical report covering Task 5: the design, cost and benefit of an industrial cogeneration system, using a high-temperature solid-oxide-electrolyte (HTSOE) fuel-cell generator.** (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 25 Feb 1981. Contract AC02-76ET11305. 59p. NTIS, PC A04/MF A01.

A literature search and review of the studies analyzing the relationship between thermal and electrical energy demand for various industries and applications resulted in several applications affording reasonable correlation to the thermal and electrical output of the HTSOE fuel cell. One of the best matches was in the aluminum industry, specifically, the Reynolds Aluminum Production Complex near Corpus Christi, Texas. Therefore, a preliminary design of three variations of a cogeneration system for this plant was effected. The designs were not optimized, nor were alternate methods of providing energy compared with the HTSOE cogeneration systems. The designs were developed to the extent necessary to determine technical practicality and economic viability, when compared with alternate conventional fuel (gas and electric) prices in the year 1990.

**22160 (DOE/ET/17103—2) Critical evaluation of fuel-processing technologies for fuel cells. Quarterly report, December 1, 1980-February 28, 1981.** (Catalytica Associates, Inc., Santa Clara, CA (USA)). May 1981. Contract AC02-80ET17103. 7p. NTIS, PC A02/MF A01.

Progress is reported on a study to evaluate the feasibility of a fuel cell power plant employing hydrocracking of No. 4 fuel oil to nephtha and light hydrocarbons where naphtha is used as feed to the syngas generator. (WHK)

**22161 (DOE/MC/14395—T1) Investigation of carbon-formation mechanisms and fuel-conversion rates in the adiabatic reformer. Annual report, March 19, 1980-March 19, 1981.** (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). 1981. Contract AC21-80MC14395. 20p. NTIS, PC A02/MF A01.

Fuel cell power plants may be required to use coal derived liquid fuels or heavy petroleum distillates as fuels. Among the fuel processor candidates, the adiabatic reformer is at the most advanced state of development. The objective of the present program is to establish a reactor model for the adiabatic reformer which will predict process stream compositions and include carbon formation processes. Four subordinate tasks were proposed to achieve the objective. These are: 1) to determine on selected catalysts rate expressions for catalytic reactions occurring in the entrance section of the adiabatic reformer; 2) to determine with microbalance experiments critical conditions for carbon formation on selected catalysts; 3) to establish a reactor model to predict process stream compositions in the adiabatic reformer using data from Task 1 for catalytic reactions and data from the literature for homogeneous gas phase reactions; and 4) to establish a model to predict carbon formation by combination of the model for process stream composition from Task 3 and data for carbon formation from Task 2. Progress is reported. (WHK)

**22162 (DOE/NASA/0067—79-6) Technology development for phosphoric acid fuel cell powerplant (Phase II): 7th quarterly report.** Christner, L. (Energy Research Corp., Danbury, CT (USA) ). Jun 1980. Contract AC01-78ET13114. 52p. NTIS, PC A04/MF A01.

Technology development of materials, cell components, and reformers for on-site integrated energy systems is described in this quarterly report. Significant progress includes: (1) improvements in internal resistance and contact resistance have been achieved; (2) dissolved gases ($O_2$, $N_2$, and $CO_2$) have no effect on the electrochemical corrosion of phenolic composites; and (3) stack performance has been increased by 100 mV over the average 1979 level.

# 32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

**22163** (CONF-791016—, pp 91-93) **Estimating residential energy consumption from the national interim energy consumption survey: a progress report.** Woteki, T.H. (Dept. of Energy, Washington, DC). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

The Office of the Consumption Data System of the Energy Information Administration is responsible for developing a comprehensive national-level data base on energy consumption. The first step in that development, a multistage area-probability-sample survey of residential energy consumption (the National Interim Energy Consumption Survey), was recently completed. The survey

is unique in that it is the federal government's first probability-sample-based empirical data on energy consumption. It is also unique with respect to the opportunities and problems in estimating energy consumption by end use. In this report, some of these methodological features and analysis problems are described. In particular, the sampling design is described, as well as the procedures for obtaining energy consumption data, the problems with missing and irregular consumption data and the way they are handled, our present plans for estimating end use, and future plans for analyses and methodological improvements.

22164 (CONF-8003114—, pp 85-97) **Conservation research and development.** Carlsith, R.S. (Oak Ridge National Lab., TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The conservation research study at ORNL is reviewed, and emphasis is shown on residential/commercial energy use. Information on major groups of projects shown in slides is heat pumps, residential and commercial appliances, community systems and cogeneration, energy demand models, energy data books, electric energy systems, low temperature storage, conservation materials, and waste treatment. Highlights of some of the individual projects are briefly discussed. (MCW)

22165 (CONF-8003114—, pp 133-143) **Energy management in DOE facilities.** Barr, D.M. (Dept. of Energy, Washington, DC). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Some short-term energy conservation goals and the responsibilities of the In-house Energy Management Division are described briefly. Energy consumption reductions that have resulted from implemented programs are indicated. Development of two programs - Energy Awareness and Vanpool Programs - is noted. Details about the retrofit programs and how to increase the possibilities of getting a specific project into the program are described. (MCW)

22166 (DOE/CE—0002) **Revised congressional budget request, FY 1982. Conservation and renewable energy program.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Mar 1981. 556p. NTIS, PC A24/MF A01.

Programs dealing with conservation and renewable energy are reprinted from the Revised Congressional Budget Request FY 1982. From Volume 7, Energy Conservation, information is presented on: buildings and community systems; industrial programs; transportation programs; state and local programs; inventor's program energy conversion technology; energy impact assistance; and residential/commercial retrofit. From Volume 2, Energy Supply Research and Development, information and data are presented on: solar building applications; solar industrial applications; solar power applications; solar information systems; SERI facility; solar international activities; alcohol fuels; geothermal; and hydropower. From Volume 6, Energy Production, Demonstration, and Distribution, information and data on solar energy production, demonstration, and distribution are presented. From Volume 3, Energy Supply and R and D Appropriation, information and data on electric energy systems and energy storage systems are included. From Volume 4, information and data are included on geothermal resources development fund. In Volume 5, Power Marketing Administrations, information and data are presented on estimates by appropriations, positions and staff years by appropriation, staffing distribution, and power marketing administrations. Recissions and deferrals for FY 1981 are given. (MCW)

22167 (ORAU/IEA—81-1(M)) **Opportunities for energy conservation in the developing countries.** Koshel, P.; Allen, E.L.; Cecelski, E.; Dougher, R.; Ring, L. (Oak Ridge Associated Universities, Inc., TN (USA)). Mar 1981. Contract AC05-76OR00033. 230p. NTIS, PC A11/MF A01.

Energy problems faced by developing countries are explored and opportunities for saving energy and for using fuels other than petroleum in the modern sector are assessed. Specific resources assessed include oil and gas, coal, hydropower, and traditional fuels. Trends in commercial energy consumption by the developing countries are assessed and the domestic fuel resources of these countries are examined. Patterns of commercial energy use in several LDCs including Sri Lanka, Haiti, India, Kenya, Egypt, the Phillippines, the Republic of Korea, and Brazil are examined. Sri Lanka and Haiti are the subjects for case studies reported in the appendixes. Opportunities for conservation in the modern sector, which include most industrial activities, transportation, and electric power generation as well as some agricultural activities and large residential and commercial buildings, are discussed. The concluding section explores policies which might be initiated by LDC governments to encourage energy conservation. (MCW)

## 3201 Buildings

*REFER ALSO TO CITATION(S) 21817, 21847, 21848, 21858, 21859, 21885, 21890, 21899, 21903, 21905, 21906, 21912, 21920, 21921, 21928, 21930, 22088, 22232, 22235, 22250*

22168 **Guide to passive cooling: model shading ordinance.** Sacramento, CA; SolarCal Council ([nd]). 137p. (NP—1902507).

Performance and perscriptive approaches are described for the design of a shading ordinance and are included in the ordinance presented. Implementation considerations and special considerations for existing buildings (retrofit) and nonresidential buildings are discussed. Existing shading ordinances are discussed for Indio and Davis, California. Energy savings due to shading replacing air conditioning is shown in two ways. A matrix showing the wide variety and choice of effective shading products on the market is shown. A model shading ordinance, specifically an ordinance for establishing window shading standards for new construction, and a sample shading compliance certificate are presented. (MCW)

22169 **(BNL—29480) Ground coupling and single-blow thermal storage in a double-envelope house.** Ghaffari, H.T.; Jones, R.F. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 6p. (CONF-810509—29). NTIS, PC A02/MF A01.

From Annual conference of the International Solar Energy Society; Philadelphia, PA, USA (26 May 1981).

The possibility of ground thermal storage and coupling in a double-shell house is investigated. Temperature distribution in the ground, utilizing measured ground temperatures, is obtained, and the amount of heat retrieval is assessed. One experimental model and several hypothetical models are introduced; their effects and advantages are compared.

22170 (CONF-8003114—, pp 65-73) **ORNL energy conservation management plan.** Donnelly, R.G. (Oak Ridge National Lab., TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Implementation of an ORNL energy conservation management plan is discussed. Creation of the General Energy Conservation Committee is described. The plan has six major features. The twenty-four division directors have been assigned the main responsibility for conserving energy in their facilities. Formal criteria to let the division directors know what they're accountable for are developed. Certain planning activities are required to let everyone know how they are going to go about conserving this energy. A list of proposed projects is required for conserving energy as the output, and funding for Engineering to evaluate the projects has been arranged. A mechanism has been set up to track the performance of each division. Each of these is detailed. (MCW)

22171 (CONF-8003114—, pp 75-83) **UCC-ND engineering program.** Choat, E.E. (Oak Ridge Y-12 Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Activities in the Environmental Control Engineering UCC Nuclear Division Engineering are summarized. Funding for the development of energy conservation projects amounts to $2 million and results from this investment are examined. Costs of the program, payback periods, annual savings in dollars and Btus are indicated. (MCW)

**22172** (CONF-8003114—, pp 251-259) **Energy management and control system, Y-12 Plant.** Corley, J.H. (Oak Ridge Y-12 Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The elements represented by the energy management and control system at the Y-12 plant in Oak Ridge are: building HVAC systems with their respective sensors and actuators, central control center, field interface devices, and data transmission network. Some capabilities of the energy management system which controls and monitors the HVAC system involving about 700 systems in 16 buildings are described. The procedure that was used to select buildings for the system and how the survey was conducted are discussed. The energy savings for each conservation action is determined by calculating the original energy consumption and the new energy consumption for each building. (MCW)

**22173** (CONF-8003114—, pp 261-268) **ORNL Energy Management System.** Hamblen, S.E. (Oak Ridge National Lab., TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The ORNL Energy Management System, as far as computer hardware, field hardware, and the connection of the system is basically the same as any EMCS. A brief description of the system is given and details are presented of the systems in buildings 4500 North and 4500 South Hood Shutdown System and in Building 4508 ventilation control. Energy savings and cost effectiveness of the systems are indicated. (MCW)

**22174** (CONF-8003114—, pp 279-286) **Energy conservation opportunities.** Edwards, P.E. (Oak Ridge National Lab., TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Energy conservation opportunities in selection of HVAC equipment and energy conservation opportunities in operation and maintenance of HVAC equipment are discussed. The opportunities in selection of HVAC equipment are illustrated by an example of a fan designed to handle 2000 cfm at one inch of static pressure. It is shown that energy reductions range from 12 to 73%. The procedure for selecting the equipment is described. (MCW)

**22175** (CONF-8003114—, pp 287-302) **Energy conservation case study, 9409-13 cooling tower: 9201-5 chiller system.** Royce, L. (Grumman Aerospace Corp., Bethpage, NY). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Energy conservation in the -13 Alpha 5 chiller system at the Y-12 plant is discussed. Specifications and operation of the present system are described. Energy consumption is determined for the present system. Some modifications to the system are recommended and then, with these modifications, energy consumed for the modified system is calculated. The modified performance now makes savings of 11% in Alpha chillers, 56% in tower fans, and 56% in the tower pumps, resulting in a 23% savings in the utility bills. Cost of implementing the modifications is analyzed. (MCW)

**22176** (CONF-8003114—, pp 345-353) **Building infiltration.** Gregory, J.W. (Oak Ridge Gaseous Diffusion Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The sources of energy loss in buildings due to infiltrations are investigated. Some information on high leakage sources (at wall outlets, windows, duct system, doors, frames, plumbing fixtures, openings, electrical fixture openings, etc.) is presented. Energy losses for various types of windows are covered. Testing methods for infiltration described include use of tracer gas, pressurization, infrared scans, and acoustical testing. (MCW)

**22177** (CONF-8003114—, pp 375-397) **Improving economic performance through insulation retrofit and the use of economic insulation thicknesses.** Powell, E.C. (Union Carbide Corp., South Charleston, WV). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Factors considered that will control economic thermal insulation thickness are identified as type of insulation, installed cost, steam plant operating cost, steam plant investment cost, average yearly wind velocity, average yearly ambient temperature, depreciation period, return on investment, hours of operation, cost of money, steam enthalpy, and maintenance cost. Some of the measures practiced in the insulation area at Union Carbide to conserve energy and maximize profit are discussed. (MCW)

**22178** **(DOE/BP—13061(Vol.1)) Pacific Northwest residential energy survey. Volume 1. Executive summary.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Aug 1980. 83p. NTIS, PC A05/MF A01.

Information obtained from residential customers with individually metered electric service within each of the 4 states (Washington, Oregon, Idaho, Montana) and 4 climate zones is summarized. Detailed findings of the data obtained from the 4030 personal interviews are presented in 7 chapters: Demographic and Family Characteristics; Dwelling Characteristics; Weatherization; Heating and Air Conditioning Systems; Water Heating; Presence and Use of Major Appliances; and Characteristics of Customers with Various Consumption Patterns. Electricity, natural gas, and fuel oil consumption data were appended to the survey data collected so that these characteristics could be related to the amount of electricity or natural gas consumed. In the appendix, comments about sampling errors are given. (MCW)

**22179** **(DOE/BP—13061(Vol.2)) Pacific Northwest residential energy survey. Volume 2. Technical appendix.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 107p. NTIS, PC A06/MF A01.

The technical appendix presents the technical aspects of the Pacific Northwest Residential Energy Survey: the survey questionnaire, exhibit cards, instructions for interviewers, and a description of the survey plan. A description of the sample plan (method used to determine which 4000 households) is given. (MCW)

**22180** **(DOE/BP—13061(Vol.3)) Pacific Northwest residential energy survey. Volume 3. Question-by-question results.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 147p. NTIS, PC A07/MF A01.

Tabulations are presented of responses to approximately 105 questions. Results are tabulated by 9 geographic regions: the four states of Idaho, Montana, Oregon, and Washington; four climate zones in the region; and a weighted Pacific Northwest total. A description of the tabulated data is given in the Introduction. Tabulated data deal with questions on dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and swelling characteristics; and insulation.

**22181** **(DOE/BP—13061(Vol.4)) Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 235p. NTIS, PC A11/MF A01.

Responses for the Pacific Northwest to fifty questions asked during the survey (plus four variables computed from responses to several other questions) cross-tabulated against responses to nine questions which represent key explanatory characteristics of residential energy use are presented. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which were cross-tabulated against the above fall into six categories: dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana with a total of 4030 households sampled. Information on the 54 tables is explained. (MCW)

**22182** **(DOE/BP—13061(Vol.5)) Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 231p. NTIS, PC A11/MF A01.

Responses for the state of Washington to fifty questions asked during the survey (plus four variables computed from responses to several other questions) cross-tabulated against responses to nine questions which represent key explanatory characteristics of residential energy use are presented. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which were cross-tabulated against the above, fall into six categories: dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana with a total of 4030 households sampled; 1468 households were sampled in Washington. An explanation of the data in the 54 tables is given. (MCW)

22183 **(DOE/BP—13061(Vol.6)) Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 235p. NTIS, PC A11/MF A01.

Responses for the state of Oregon to fifty questions asked during the survey (plus four variables computed from responses to several other questions) cross-tabulated against responses to nine quesions which represent key explanatory characteristics of residential energy use are presented. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which were cross-tabulated against the above, fall into six categories: dwelling characteristics; heating and air-conditioning system; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana with a total of 4030 households samples; 1165 households were sampled in Oregon. (MCW)

22184 **(DOE/BP—13061(Vol.7)) Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 235p. NTIS, PC A11/MF A01.

Responses for the state of Idaho to fifty questions asked during the survey (plus four variables computed from responses to several other questions) cross-tabulated against responses to nine questions which represent key explanatory characteristics of residential energy use are presented. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which were cross-tabulated against the above, fall into six categories: dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana with a total of 4030 households sampled; 827 households were sampled in Idaho. (MCW)

22185 **(DOE/BP—13061(Vol.8)) Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 235p. NTIS, PC A11/MF A01.

Responses for the state of Montana to fifty questions asked during the survey (plus four variables computed from responses to several other questions) cross-tabulated against responses to nine questions which represent key explanatory characteristics of residential energy use are presented. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which are cross-tabulated against the above, fall into six categories: dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana with a total of 4030 households sampled; 570 households were sampled in Montana.

22186 **(DOE/BP—13061(Vol.9)) Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 236p. NTIS, PC A11/MF A01.

Responses for Climate Zone 1 to fifty questions asked during the survey (plus four variables computed from responses to several other questions) are presented. Climate Zone 1, defined according to the sum of heating and cooling degree days, amounts to less than 6000. The fifty questions were cross-tabulated against responses to nine questions which represent key explanatory characteristics of residential energy use. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which were cross-tabulated against the above fall into six categories; dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana, with a total of 4030 households sampled; 1873 households were sampled in Climate Zone 1. Information in 54 tables is explained. (MCW)

22187 **(DOE/BP—13061(Vol.10)) Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 232p. NTIS, PC A11/MF A01.

Responses for Climate Zone 2 to fifty questions asked during the survey (plus four variables computed from responses to several other questions) are presented. Climate Zone 2, defined according to the sum of heating and cooling degree days, amounts to 6000 to 6999. The fifty questions were cross-tabulated against responses to nine questions which represent key explanatory characteristics of residential energy use. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which were cross-tabulated against the above fall into six categories: dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana, with a total of 4030 households sampled; 685 households were sampled in Climate Zone 2. Informational data are presented in 54 tables. (MCW)

22188 **(DOE/BP—13061(Vol.11)) Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 236p. NTIS, PC A11/MF A01.

Responses for Climate Zone 3 to fifty questions asked during the survey (plus four variables computed from responses to several other questions) are presented. Climate Zone 3 is defined according to the sum of heating and cooling degree days, and amounts to 7000 to 7999. A map outlines these four zones. The fifty questions were cross-tabulated against responses to nine questions which represent key explanatory characteristics of residential energy use. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which were cross-tabulated against the above fall into six categories: dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana, with a total of 4030 households sampled. 480 households were sampled in Climate Zone 3. Information on 54 tables is explained. (MCW)

22189 **(DOE/BP—13061(Vol.12)) Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). Jul 1980. 236p. NTIS, PC A11/MF A01.

Responses for Climate Zone 4 to fifty questions asked during the survey (plus four variables computed from responses to several other questions) are presented. Climate Zone 4 is defined according to the sum of heating and cooling degree days, and amounts to over 8000. A map outlines the four zones. The fifty questions were cross-tabulated against responses to nine questions which represent key explanatory characteristics of residential energy use. The nine key questions are: means of payment for housing; type of dwelling; year dwelling built; total square-footage of living space; type of fuel for main heating system; combined 1978 income; unit cost of electricity; annual electricity consumption; and annual natural gas consumption. The fifty questions and four computed variables which were cross-tabulated against the above fall into six categories: dwelling characteristics; heating and air-conditioning systems; water heating; appliances; demographic and dwelling characteristics; and insulation. The survey was conducted throughout the states of Washington, Oregon, Idaho, and Montana, with a total of 4030 households sampled; 992 household were sampled in Climate Zone 4. Information on 54 tables is explained. (MCW)

22190 **(DOE/CE/20220—1) Handbook of energy use for building construction.** Stein, R.G.; Stein, C.; Buckley, M.; Green, M. (Stein (Richard G.) and Partners, New York (USA)). Mar 1981. Contract AC02-79CS20220. 191p. NTIS, PC A09/MF A01.

Information is provided for building designers to determine the energy required for buildings construction and to evaluate the energy required for alternative materials, assemblies, and methods. The information is also applicable to large-scale planning and policy determination providing the means to estimate the energy required to carry out major building programs. Details are presented in the following: construction sectors and the US economy; overall energy use by construction sectors; breakdown of energy use by construction sectors; energy use per square foot for new building construction; energy per unit of building material; energy in typical building assemblies; energy cost/benefit studies; percentage of industry output going to building construction; energy flow model; and labor per unit of building material. (MCW)

22191 **(DOE/CE/60467—02) Energy-conservation opportunities in lighting.** (Massachusetts Building Code Commission, Boston, MA (USA)). Apr 1981. Contract FG01-79CS60467. 34p. NTIS, PC A03/MF A01.

Technologies and techniques which can be employed by your existing personnel - without the need for consultants - to reduce your lighting costs by as much as 70% are discussed. Four basic steps to reduce energy costs and improve the effectiveness of the lighting system discussed are: get acquainted with some of the basic terminology and energy efficient lamps and fixtures which are on the market; conduct a survey of the building to determine where and how much energy and money can be saved in the process; implement the simple, low-cost or no-cost measures immediately; and calculate the payback period for capital investment modifications, and implement those which make economic sense. Case studies are used to illustrate the recommendations. (MCW)

22192 **(DOE/CS/20068—4(Vol.2)(App.)) Georgetown University Integrated Community Energy System (GU-ICES). Phase III, Stage I: feasibility analysis. Final report.** (Georgetown Univ., Washington, DC (USA); Pope, Evans and Robbins, Inc., New York (USA)). Oct 1980. Contract AC02-77CS20068. 204p. NTIS, PC A10/MF A01.

Candidate energy alternatives are analyzed in Phase III, Stage I, and the appendices are presented for the feasibility analysis. Information in eight appendices includes the following: detailed statement of work; PEPCO rate schedules; cogeneration schemes; added coal, limestone, and ash storage; hot and cold thermal storage; absorption refrigeration; high temperature heat pumps; and life cycle cost analysis. (MCW)

22193 **(DOE/ET/26716—T1) Preliminary market analysis for customer side of the meter thermal-energy storage.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). 31 Dec 1979. Contract AC01-78ET26716. 94p. NTIS, PC A05/MF A01.

An examination is made of the potential market size for thermal energy storage space heating, water heating, and air conditioning in the residential and commercial sector. It is concluded that a significant market for TES could develop over the next 20 years; the analysis considers the electric utility perspective, the perspective, and the expected market in detail. (MCW)

22194 **(DOE/TIC—11453) Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes.** (AIA Research Corp., Washington, DC (USA)). 1979. Contract AC01-79CS20524. 99p. NTIS, PC A05/MF A01.

Research to develop technical information on the designed energy performance of mobile homes is described. In Phase 2, how much less energy mobile homes could be designed to use is estimated. Four prototype models were derived, with some adjustments, from the NAHB/RF Phase 1 survey. The prototypes were then used to develop four designs for mobile homes with the purpose of achieving the maximum technically feasible level of energy conservation. Finally, the maximum technically feasible designs and the prototype designs were compared with the prototypes as modified to the proposed increases in thermal performance in the April 1978 version of HUD's Minimum Property Standards (HUD/MPS).

22195 **(DOE/TIC—11454) Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes.** (AIA Research Corp., Washington, DC (USA)). Jan 1979. Contract AT01-76CS73015. 105p. NTIS, PC A06/MF A01.

Results of a research project to develop technical information upon which nationally uniform and locally responsive energy performance standards could be based are presented. Detailed comparative sets of information about the designed energy performance of buildings represented in the Phase 1 data base are given. The comparative sets presented include information on buildings: as originally designed for construction in 1975 to 1976; as modified to conform to current energy standards; and as if they were designed to achieve maximum practicable levels of energy conservation in 1978. Development of issues relating to a format for the publication of whole-building energy performance standards and a comparison of quantitative results by alternative estimating methods is accomplished. The approaches used to derive the data are explained. (MCW)

22196 **(DOE/TIC—11455) Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: single-family dwellings.** (AIA Research Corp., Washington, DC (USA)). Jan 1979. Contract AT01-76CS73015. 197p. NTIS, PC A09/MF A01.

The single-family residential research project that developed information upon which nationally uniform and locally responsive energy performance standards for new building design could be based is documented. The project refines and expands the work of Phase 1 which provided information on the amount of energy that residential buildings are currently designed to use and which included a survey of 123,558 single-family dwellings constructed in 1975 and 1976. Section 1 describes the research undertaken; Section 2 describes the maximum technically feasible design program in detail and Section 3 describes technical issues that arose from the research. (MCW)

22197 **(DOE/TIC—11456) Phase two report for the development of energy performance standards for new buildings. Appendix D. Energy conscious designs.** (Department of Housing and Urban Development, Washington, DC (USA). Office of Policy Development and Research). Jan 1979. Contract AT01-76CS73015. 587p. NTIS, PC A25/MF A01.

Appendix D includes selected drawings from each of the 168 commercial and multifamily redesigns, the 20 energy-conserving single-family dwelling designs, and the 4 energy-conserving mobile home prototypes. Individual drawings from each project were

chosen as the most illustrative of the energy conscious design strategies used. They are organized to reflect the conceptual framework of location, form, and metabolism emphasized throughout the project. Project drawings are accompanied by descriptions of the key energy-related design concepts abstracted from summary reviews of each project. The mobile home prototypes are described by their design specifications. The architects, engineers and/or homebuilders for each project are identified, and the projects are grouped by building type and geographic regions (east, midwest, and west). The drawings and descriptions serve to describe practicable limits of energy conscious design today. (MCW)

22198 **(DOE/TIC—11457) Phase-two report for the development of Energy-Performance Standards for new buildings. Final report.** (AIA Research Corp., Washington, DC (USA)). Jan 1979. Contract AT01-76CS73015. 248p. NTIS, PC A11/MF A01.

Phase 2 results of a research project to develop technical information upon which nationally uniform and locally responsive energy performance standards could be based are documented. The design of the program is given in an overview including the design and methodology of Phase 1 (designed to produce information on the amount of energy that buildings are currently designed to use) and the design and methodology of Phase 2 (development of comparative sets of information about the designed energy performance of the buildings represented in Phase 1). Parts 2, 3, and 4 discuss the data for commercial and multi-family residential buildings, single-family residential buildings, and mobile homes, respectively. Part 5 presents the energy performance format issues and Part 6 discusses the comparative analysis of commercial estimates. (MCW)

22199 **(DOE/TIC—11460) Sampling variability for redesign buildings.** (Brown Associates, Silver Spring, MD (USA)). 5 Jan 1980. 216p. NTIS, PC A10/MF A01.

Estimates of the relative sampling variability of budget percentiles for building type HDD/CDD matrices are presented for small and large offices, elementary and secondary schools, clinics, gyms, community centers, theaters, stores, shopping centers, storage, nursing homes, hotels, motels, high- and low-rise apartments. (MCW)

22200 **(DOE/TIC—11461) Budget percentiles for baseline and redesigned commercial type buildings based on resource utilization factors (RUF) for cities with try weather tapes.** (Brown Associates, Silver Spring, MD (USA)). 17 Sep 1979. 99p. NTIS, PC A05/MF A01.

Data are tabulated for budget percentiles based on resource utilization factors for offices, elementary and secondary schools, hospitals, clinics, nursing homes, gyms, community centers, hotels, motels, theaters, stores, shopping centers, storage, and apartment buildings in some specific US cities. Tabulated data are also presented on budget percentiles by some specific cities based on resource utilization (in 1000 Btu/ft$^2$/y) for small and large offices, low-rise apartments, hospitals. (MCW)

22201 **(DOE/TIC—11462) Budget percentiles for baseline and redesigned all commercial building types assuming no cooling.** (Brown Associates, Silver Spring, MD (USA)). Jul 1979. 84p. NTIS, PC A05/MF A01.

Estimates are presented of the budget percentiles for baseline buildings as well as redesign buildings. Estimates are given for a large number of combinations of heating degree days (Base 60°) and cooling degree days (Base 50°), derived from the HDD (base 65°) and CDD (Base 65°) combination for 226 places as given in the Climate Atlas of the US. Places in the Climate Atlas arranged alphabetically are listed in Table A. Table B is entitled: Places Listed in the Climate Atlas Listed by the Same CDD (Base 50) Intervals as Budget Percentile Tables. Tabulated budget percentiles are given on: small and large offices; elementary and secondary schools; hospitals; clinics; gyms; community centers; nursing homes; hotels/motels; theaters; stores; shopping centers;storage; and apartment buildings. (MCW)

22202 **(DOE/TIC—11463) Budget percentiles for baseline and redesigned: theaters, stores, shopping centers, storage, hi-rise apartments; low rise apartments.** (Brown Associates, Silver Spring, MD (USA)). Jul 1979. 223p. NTIS, PC A10/MF A01.

Estimates are given for a large number of combinations of Heating Degree Days (Base 60°) and Cooling Degree Days (Base 50°), derived from the HDD (Base 65°) and CDD (Base 65°) combination for 226 places as given in the Climate Atlas of the United States (listed in Table A). Table B presents data on the places listed in the Climate Atlas listed by the same CDD (Base 50) intervals as budget percentile tables. Baseline and redesign budgets at various percentiles are given for the following building types: theaters, stores, shopping centers, storage, high- and low-rise apartments. (MCW)

22203 **(DOE/TIC—11464) Errata, nursing homes. Budget percentiles for baseline and redesigned commercial type buildings: cities with try weather tapes; based on resource utilization factors (RUF); based on price weighting factors (PWF).** (Brown Associates, Silver Spring, MD (USA)). 22 Oct 1979. 10p. NTIS, PC A02/MF A01.

Corrected data are presented for the P50 Redesign figure for nursing homes in the following documents in the series entitled Budget Percentiles for Baseline and Redesigned Commercial Type Buildings: For Cities with TRY Weather Tapes, Based on Price Weighing Factors (PWF), and Based on Resource Utilization Factors (RUF). (MCW)

22204 **(EMD—81-2) Improved data and procedures needed for development and implementation of building energy performance standards.** Staats, E.B. (General Accounting Office, Washington, DC (USA)). 23 Dec 1980. 37p. General Accounting Office, Gaithersburg, MD.

Report to the Congress by the Comptroller General of the United States.

Energy conservation standards for new buildings being developed by the DOE are discussed. Specifically, it addresses: (1) what still needs to be done before sound standards can be issued, (2) the need to transfer implementation responsibility for the standards from the US HUD to the DOE, and (3) the inappropriateness of the proposed sanction for noncompliance in view of the large decrease in expected energy savings.

22205 **(LA—8295-MS) DOE-2 Verification Project. Phase I. Interim report.** Diamond, S.C.; Hunn, B.D.; Cappiello, C.C. (Los Alamos Scientific Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 77p. NTIS, PC A05/MF A01.

An analytical and empirical verification of DOE-2 as a computational unit rather than as separate algorithms is described. Results of the crosscheck of DOE-2 with ASHRAE loads calculative procedures, as well as the results of a line-by-line check of program constants and flag-setting algorithms, are reported. Also, results of a comparison of plant equipment performance default values with manufacturers' data are presented, as are results of a series of comparisons of DOE-2 solar simulator predictions with predictions of other solar system simulation computer programs. Results of empirical tests of the full DOE-2 program are also presented, including comparisons with measured monthly and annual energy consumption for seven commercial buildings located in seven different cities and for nine elementary schools. In addition, comparisons of predicted results of several building energy analysis computer programs, including DOE-1.4 and DOE 2.0, and the results of the manual calculative method developed by ASHRAE Technical Committee 4.7 (Energy Calculations) are reported.

22206 **(LBL—11701) Progress in residential energy conservation: a multi country perspective.** Schipper, L.; Meyers, S.; Ketoff, A. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 15p. (CONF-810423—6). NTIS, PC A02/MF A01.

From 1. International Energy Agency (IEA) conference on new energy conservation technologies and their commercialization; Berlin, F.R. Germany (6 Apr 1981).

The importance of understanding historical and present day patterns of energy use is illustrated with a summary of a recently

completed, comprehensive data base of residential energy consumption from 1960 to 1978 in seven OECD countries. Time-series data on key structural factors, energy-using stock, unit energy consumption, and total consumption are summarized for the major end-uses; space heating, hot water, cooking, and electric appliances. Indicators of intensity are developed, and comparisons of space heating and other uses among countries are discussed. Using such indicators, the historical development of energy use in this sector can be analyzed for the first time. Evidence of a marked slowing of the growth in residential energy demand - and signs of a possible decline - are presented. It is argued that such information is vital to understanding the setting in which new energy-saving technologies are implemented, yet few nations or international agencies are providing this kind of data or analysis. Integration of detailed macrodescriptions of present day energy use patterns with measured savings from new conservation techniques is vital for understanding future energy demands in the residential sector, which are still overstated by many national governments.

22207 **(NP—1902593) Solid-fuel cooking stoves: bibliography.** (Tata Energy Research Inst., Bombay (India)). May 1981. 29p. NTIS (US Sales Only), PC A03/MF A01.

Forty-two citations with abstracts are presented which deal with stove designs that use coke, coal, firewood, biomass, etc. (MCW)

22208 **(NYSERDA—80-26) Institutional barriers to energy conservation in Mitchell-Lama housing.** Baldwin, F.D. (New York State Energy Research and Development Authority, Albany (USA)). Oct 1980. 42p. New York State Energy Research and Development Authority, Albany, NY.

Institutional obstacles to conserving energy in 283 State-assisted housing projects, commonly known as Mitchell-Lama housing, for lower-income and middle-income households in New York State are analyzed. Some of the problems discussed are common to much multifamily housing, such as inadequately trained building superintendents; others involve factors directly related to the New York program's history, such as tax shelters that weaken owner incentives to invest in energy conserving improvements. The report is based on a review of existing literature, analysis of State data on energy consumption within the projects, and interviews with a wide range of officials and private individuals, mostly conducted during the spring and summer of 1980. Recommendations for Legislative and administrative action are given.

22209 **(ORNL/Sub—81/13800/1) Development of advanced insulation for appliances. Task I report.** Ruccia, F.E. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jun 1981. Contract W-7405-ENG-26. 141p. NTIS, PC A07/MF A01.

Efforts to develop advanced insulation concepts for residential and commercial water heaters, refrigerators, freezers, and ovens are discussed. The threshold target for these insulations is a thermal resistance, for a 1-in. thickness, of 20 $h.ft^2.°F/Btu$. The program should also provide a path to commercialization of these new concepts. The general approach involved two basic steps to produce the data which could be used to evaluate the technical and economic feasibility of different insulation systems. First, the energy savings which could be obtained by significantly improving the insulation used in present day appliances were evaluated. Second, a number of different advanced insulation systems were evaluated conceptually to estimate the R/in values that could be achieved. This included both evacuated and nonevacuated systems. Finally results of these two analyses were compared to identify the more promising systems for further development. This was done by calculating simple years-to-payback based on estimated energy savings and the estimated added cost using 1979 fuel prices and costs. Those systems which have a potential years-to-payback of less than 7 years for at least one application, have been selected as candidates for additional development work. The results of this analysis are summarized. This analysis identified two types of insulation systems which could meet the threshold value of R/in = 20. These are evacuated systems and gas-filled powders. (MCW)

22210 **(ORNL/Sub—7715/4) Operating temperatures of recessed fluorescent fixtures with thermal insulation.** Yarbrough, D.W.; Toor, I.A. (Tennessee Technological Univ., Cookeville (USA). Dept. of Chemical Engineering). May 1981. Contract W-7405-ENG-26. 22p. NTIS, PC A02/MF A01.

Tests were performed to determine steady state surface temperatures for recessed fluorescent fixtures operated with and without thermal insulation on the top side of the fixture and to identify potential problems associated with the installation of thermal insulation. In addition to measuring temperatures, means were sought by which the fixtures can be thermally insulated and operated without fire hazards or damage to the fixture. (MCW)

22211 **(P—400-80-036) High rise buildings.** Horn, M. (California Energy Commission, Sacramento (USA)). Jun 1980. 8p. California Energy Commission, Sacramento, CA.

The feasibility of developing new energy conservation standards for high rise residential-type buildings including hotels, motels, apartment houses, and lodging houses is discussed. Differences between the high and low rise residential building energy regulations are summarized. The data collection method and results are presented. (MCW)

22212 **(PNL—3312) Analysis of institutional issues in the implementation of Federal energy-performance standards for new buildings.** Sawyer, C.H.; Keller, D.; Robinett, K.; Cole, R.J.; Lawson, L.; Nerheim, M. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Mar 1980. Contract AC06-76RL01830. 336p. NTIS, PC A16/MF A01.

Institutional (legal, organizational, and political) impediments to and impacts of Standards implementation by the Federal, state, and local governments are discussed. The background chapter discusses previous Federal actions to stimulate greater energy efficiency in buildings; describes the scope and content of the Standards; discusses the purpose for the implementation analysis; outlines the approach to and scope of the analysis. The approach of the analysis is described in Chapter 2. Chapter 3 describes four alternatives for the implementation of Federal energy performance standards for new buildings (no action; no Federal sanctions - Federal incentives; Federal sanctions - Federal incentives; and Federal sanctions - No Federal incentives). Chapter 4 discusses the Federal institutional baseline; Chapter 5 discusses Federal impacts by alternative. Other chapters are: Selection of States and Local Jurisdictions for Analysis; State and Local Institutional Baseline (Overview); State and Local Impediment to Standards Compliance; Likely State and Local Compliance Responses by Alternative; and State and Local Impacts of Standards Compliance. Federal Baseline Data; Institutional Baseline For Selected States and Local Jurisdictions; and Liability Issues are presented in appendices. (MCW)

22213 **(SAI—444-80-299-LJ) Cooling-and-heating-load improvements in seasonal-performance modeling of room and central air conditioners and heat pumps.** (Science Applications, Inc., La Jolla, CA (USA)). 21 Mar 1980. Contract AC03-79CS10757. 104p. NTIS, PC A06/MF A01.

The Seasonal Performance Model (SPM) has been developed to evaluate the seasonal cooling and heating performance of room air conditioners and central air conditioners and heat pumps. This model requires sizing the load to the product; the sizing is based on the Manual J procedure, with some minor modifications. The focus is on improving the product sizing technique of SPM by using a more realistic load estimate. A computer simulation program (SPMLD) was used to calculate the cooling and heating loads on an hourly basis. The results obtained indicate that a fairly good agreement exists between the hourly simulation (SPMLD) treatment and SPM treatment, when the following improvements are applied to the SPM model: a correction factor to the SPM infiltration rate for cooling load calculation, a correction factor to the SPM solar heat gain for cooling load calculation, shifting the zero load point from 65°F to 60°F outdoor temperature for heating load calculations.

**22214 Beamed daylighting: historical review, current testing and analysis and design options.** Eacret, K.M. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1174-1178(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Beamed Daylighting refers to techniques for daylighting deep within building interiors, beyond the perimeter zone in which diffuse light from the sky is available. The results of testing of various Beamed Daylighting prototypes, the findings of a review of patent documents in the field, and some options for design using Beamed Daylighting techniques are discussed.

**22215 Innovative, efficient daylighting designs.** Ashley, C.M.; Ashley, D.C.; Kinney, L.F. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1179-1182(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

A number of daylighting techniques are discussed. A number of designs are discussed and 1/4 scale models of two of the most promising will be demonstrated. In addition, several techniques for predicting the performance of generic daylighting shcemes are presented. Finally, inferences from empirical and analytical work in daylighting will be drawn and suggestions made concerning the applicability of newly-developed daylighting schemes in existing and new buildings and potentially fruitful avenues for further inquiry.

**22216 Graphic daylighting design method: including clear sky conditions.** Millet, M.S.; Adams, C.; Bedrick, J.R. (Univ. of Washington, Seattle). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1183-1187(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The University of Washington Graphic Daylighting Design Method (GDDM) has been developed as a graphic design tool for architects in assessing both qualitative and quantitative aspects of daylighting design. Use of the method is based on a catalogue of Patterns of daylight distribution in isolux contours over a horizontal reference plane from window and skylight opening. Investigations are now being conducted into extending its use to cover clear Sky conditions and various modifiers such as external obstructions, jambs, and shading devices. Directions being pursued in extending its use to cover critical design conditions are reported.

**22217 Index to quantify thermal comfort in homes.** Carroll, J.A. (Univ. of California, San Diego, La Jolla). Contract AC04-79AL10891. *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 1210-1214(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

The discomfort index presented here quantifies the thermal discomfort associated with the design and operation of residential buildings during the heating season. Discomfort under steady-state conditions is estimated from the squared difference between the actual and a preferred temperature (which is assumed to vary with clothing and activity levels). The difference is found using a simple linear approximation to the ASHRAE ET that treats humidity effects only implicity. A penalty is also assessed for transient discomfort effects. The index allows calibration for individual preferences. The proposed index is similar to the currently used Predicted Percentage of Dissatisfied, but is simpler and better suited to simulations of residential environments. Simulations can integrate the index over a heating season along with energy use to estimate the overall thermal performance of a building. These two complementary aspects of performance can be combined into one overall index, by using thermostat settings as an indicator of the relative weights that people assign to comfort and energy use.

**22218 Integrating optimized evaporative cooling systems with passive homes, concepts and results.** Peck, J.F.; Kessler, H.J. (Univ. of Arizona, Tucson). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 952-956(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Two evaporatively cooled, massively constructed hybrid solar homes based on a standard merchant built home design as well as a standard low mass home were built. The interior air, wall surface, and globe thermometer temperatures are compared. The effect of mass, cooler location, zoned introduction of cool air and heat rejection at heat entry points into the house is discussed. Performance data is given indicating that the hybrid solar home was more comfortable than the standard home, and that off peak cooling of massive homes is possible.

**22219 Project planning and design for energy conservation.** Gibson, N.S. (Georgia Inst. of Tech., Atlanta). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **3.2**: 1303-1307(1980). (CONF-800604—P3). Phoenix, AZ, USA (2 Jun 1980).

Under a contract with the Community Systems Branch of the Office of Conservation and Solar Energy at the Department of Energy, a team of economists, planners, architects, and engineers performed a case study to analyze the various systems, approaches, and design techniques necessary to plan for energy conservation at and within the community level. A case study format allows for specific measurements and comparisons to be made among the alternatives considered and the base plan; these measurements and comparisons were made for construction costs, energy consumption, and the life cycle costs of the entire community for the appropriate development time horizon.

**22220 Energy management handbook for state facilities.** Nashville, TN; Tennessee Energy Authority (1980). 136p. (NP—1902603).

The handbook provides information for maintenance managers of Tennessee state-owned facilities to implement an energy management program. An overview of how energy can be saved and information about conducting an energy audit are presented. Recommendations are included for building envelope; space HVAC systems; lighting; domestic hot water; computer facilities; elevators; laundries; kitchens; etc. (MCW)

**22221 Use of the atop system in the control of an off-peak storage device.** Winn, C.B.; Robinson, K. (Colo State Univ, Fort Collins). *Proceedings of the IEEE Conference on Decision and Control ;* **2**: 911-916(1979). (CONF-791222—).

From 18. IEEE conference on decision and control; Fort Lauderdale, FL, USA (12 Dec 1979).

An off-peak heat storage device has been installed in Colorado State University Solar House I. The device may be charged with heat during the off-peak hours (10 pm to 6 am) and the heat may then be utilized as required in order to satisfy the building heating requirements that are not satisfied by the solar system. A methodology for determining the amount of heat required to be stored and for determining an optimal charging sequence is presented. Quantitative results obtained during the past heating season (1978-79) are also presented. 7 refs.

**22222 (DOE/TIC—11459) Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings.** (Department of Housing and Urban Development, Washington, DC (USA). Office of Policy Development and Research). [nd]. Contract AT01-76CS73015. 374p. NTIS, PC A16/MF A01.

The commercial and multi-family residential research project that developed information upon which nationally uniform and locally responsive energy performance standards for new building design could be based is documented. Comparative sets of information about the designed energy performance of the buildings represented by samples are developed. In the commercial and multi-family high-rise residential building sector, the sample was designed to include 3221 randomly selected buildings. Usable information was obtained from the energy-related design characteristics of 1661 buildings which was considered an adequate basis for statistical analysis. The designed energy performance of the buildings was estimated using a short-form version of a computer program called AXCESS. The individual building estimates were used as the basis for estimates of the designed energy performance of the whole population of buildings represented by the sample, using a statistical process called parametric analysis. Graphs summarizing the ranges of performance of each building type identified five points for each

building type: the high and the low levels of designed energy performance; the 20% that used the least energy (the 20th percentile); the 20% that used the most energy (the 80th percentile); and the mean. These figures were tabulated for each of the building types for all of the seven climatic regions. (MCW)

## 3202 Transportation

22223 **Liquid fuel conservation: an opportunity for local governments.** Sacramento, CA; SolarCal ([nd]). 51p. (NP—1902508).

This document is intended to fulfill two objectives: first, to provide information which will be useful to local officials in taking action for liquid fuel conservation programs in their areas; and, second, to present suggested elements that such a liquid fuel program might contain. Brief information is given on programs in San Bernadino County (compact vehicles), City of San Diego (government operations), and City of Davis (driver training).

22224 (CONF-801045—, pp 91-101) **Some factors influencing estimators in motor gasoline demand models.** Stine, R.A.; Small, R.D. (Univ. of Pennsylvania, Philadelphia). Apr 1981. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

In this paper we survey the recent literature on motor gasoline demand models and their estimates of price and income elasticities. We find tremendous variation in the estimates of these two quantities and investigate several possible sources of this variation. Using the sequence of estimates that result from sliding a window through the data, we show that the period of estimation is the major cause of the variation. Using the sliding window technique, we relate the pattern in the estimates of elasticities to patterns in the original data, and we also investigate the usefulness of $R^2$ in evaluating such models as forecasting tools.

22225 (CONF-801045—, pp 116-126) **Raster color displays: examples, ideas, and principles.** Carr, D.B. (Pacific Northwest Lab., Richland, WA). Apr 1981. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

This paper concerns the use of color for displaying data. The focus is on general uses of color. More specifically, this presentation deals with using color for (1) aesthetic purposes and conveying emotion, (2) identifying data and helping to form gestalts, (3) representing ordered variables, and (4) enhancing three-dimensional views. Some general guidelines and illustrations are presented as the last three topics are addressed. Because color is only one of several important factors in the display of data, this discussion also includes topics related to color use, such as size reduction and scaling.

22226 **(DOE/IR/05106—T23) Analyzing opportunities for energy conservation in municipal fleet management: service delivery patterns, equipment, supply, operations, and maintenance. Information bulletin of the energy task force of the urban consortium.** (Public Technology, Inc., Washington, DC (USA)). 1980. Contract FG02-78IR05106. 39p. NTIS, PC A03/MF A01.

Vehicle fleet management as a five-step process is portrayed and the multiple energy conservation opportunities within each step are examined. The five steps described are, configuration of service area and service delivery patterns, equipping the fleet, operating the fleet, maintaining the fleet, and supplying the fleet with fuel. A systems approach to decision making about municipal fleets is outlined. Management options, control techniques, and devices are suggested for each of the five steps. Reference is made to analytic tools which will assist in deliberating options at each of these steps. These tools are presented in a list. Four concise case studies of jurisdictions which are taking deliberate steps to reduce fuel use are presented. Key opportunities for fuel conservation are then summarized, followed by a selected bibliography, and listing of reference materials and additional resources.

22227 **(LA-UR—81-813) Model simplification: a case study of end use demand modeling in the transportation sector.** Ford, A. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-810701—2). NTIS, PC A02/MF A01.

From Computer simulation conference; Washington, DC, USA (15 Jul 1981).

The design of a rather simple model of petroleum use by automobiles in the US economy is considered. The model must be simple to allow it to function within a larger end use demand model under construction for use within the FOSSIL2 modeling system. The simple model has been designed so that its behavior under reasonable conditions will resemble the behavior of a much more complex model of the nation's transportation system. The complex model is known as ENTRANS. The model simplification approach described requires a summary of the behavioral response of the more complex model in a form that is readily mimicked by the simple model. The band of uncertainty in the relationships used in the simple model are determined through sensitivity testing of the more complex model. Problems inherent in the model simplification process are discussed in the concluding portion of the paper.

22228 **(UMTA-NY—06-0048-81-1) Evaluation of the Rochester, New York Community Transit Service Demonstration. Volume I: Executive Summary. Final report, November 1977-March 1980.** Newman, D.A.; Holoszyc, M. (Systan, Inc., Los Altos, CA (USA)). Oct 1980. 37p. NTIS.

The most significant demonstration findings of a public and private operation providing dial-a-ride and handicapped services are presented. Performances are compared. The demonstration also includes a unique funding strategy that shifted responsibility to the local towns served by dial-a-ride vehicles. The results of the demonstration including the implementation process, the level of service provided to users, the demand response, and the services' operating efficiency, are evaluated. The implications of the Rochester experience are summarized for the benefit of other localities interested in implementing similar services. An epilogue section, documenting activities that have occurred since the demonstration ended, is also included. (MCW)

## 3203 Industry And Agriculture

*REFER ALSO TO CITATION(S) 21491, 21538, 21539, 21558, 21559, 21732, 22088, 22110, 22159, 22171, 22255, 22266, 22267, 22423*

22229 (ANL/EES-TM—130, pp 1-9) **Air quality analysis of Phase I of the proposed oil backout legislation: Introduction.** Oct 1980. NTIS, PC A05/MF A01.

In Air quality analysis of Phase I of the proposed oil backout legislation.

On March 6, 1980, the President proposed legislation to reduce the use of oil and natural gas in electric utility power plants by the equivalent of one million barrels per day by 1990. The program was structured in two phases: Phase I, a mandatory program for the conversion to coal of certain specified coal-capable power plants currently burning oil or natural gas; Phase II, a voluntary program of replacements through economic incentives. This report presents an assessment of the air quality implications of Phase I of the proposed legislation.

22230 **(CONF-8003114—) Proceedings of the energy conservation in design for UCC-ND managers and specialists.** (Oak Ridge National Lab., TN (USA)). Jan 1981. Contract W-7405-ENG-26. 481p. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Separate abstracts are prepared for 35 papers presented at the symposium. (MCW)

22231 (CONF-8003114—, pp 47-52) **Union Carbide Corporation: energy conservation program.** McBride, R.B. (Union Carbide Corp., South Charleston, WV). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

An overview is presented of the energy conservation program at Union Carbide Corporation, excluding the Nuclear Divi-

sion. Two important aspects of the program are the energy audits and the project implementation. They represent a search for opportunity to save energy and a methodology for making improvements. Slides show information and data on energy use and purchases; energy saved to date; improvement in efficiency of energy use since 1972; and 1985 energy conservation goals for the principal divisions. (MCW)

22232 (CONF-8003114—, pp 53-64) **UCC-ND energy conservation program to date.** Oliphant, G.W. (Oak Ridge National Lab., TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The UCC-ND energy conservation program to date is reviewed. The organization of the program, the history, some of the goals and directives, some actions, results, and the challenge that is needed to accomplish some proposed goals are discussed. Twenty-three slides were used to illustrate the talk. (MCW)

22233 (CONF-8003114—, pp 169-181) **Application of penalty factors in procurement.** Felte, J.F. (Oak Ridge Gaseous Diffusion Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The application of capital penalty factors in procurement is indicated to impact on the evaluation of equipment bids. The presentation provides understanding of the capital cost penalty and shows how it is applied in the procurement of energy consuming equipment. Application of applying Capital Cost Penalty requires writing an Energy Clause which is one section of an equipment specification. Major elements of the energy clause (the Criteria, the Bid Evaluation Procedure, and the Certification of Testing) are described. The penalty factor is applied to the bid evaluation process. An example is shown for the procurement of a fan. (MCW)

22234 (CONF-8003114—, pp 219-244) **Energy conservative motors.** Montgomery, D.C. (General Electric Co., Nashville, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

Methods for comparing the performance and cost of electric motors for industrial use are presented and discussed. It is concluded that it is no longer meaningful just to look at price in making a cost comparison of motors. It is essential to include an evaluation of efficiency, and that purchasers specify a guaranteed minimum efficiency for each motor bought. (LCL)

22235 (CONF-8003114—, pp 269-277) **Kathabar runaround energy recovery systems.** Jones, P.C. (Oak Ridge Y-12 Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The kathabar runaround energy recovery system under construction at the Y-12 plant in Oak Ridge is described. The energy conserving features of the kathabar system are discussed and a schematic of the system is given. (MCW)

22236 (CONF-8003114—, pp 463-474) **Co-generation.** Shapiro, T. (Oak Ridge National Lab., TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The history of the Y-12 steam Plant is reviewed and its operating characteristics are examined in order to investigate its potential for energy production (cogeneration). Power cycles considered are: condensing power generation cycle and utility steam load; non-condensing cycle with excess steam capacity; non-condensing cycle at current utility demand; and low pressure non-condensing cycle. The ratings of the units and other specifications are noted. The maximum cogeneration potential is determined and the basic economics of such a system is analyzed. Actual performance data from the plant are given for 1979. The cost to generate the potential power at the Y-12 Plant is compared with that purchased from TVA. (MCW)

22237 (CONF-8003114—, pp 475-489) **Power recovery and utilization program applicable to the gaseous diffusion process.** Lenihan, W.S. (Oak Ridge Gaseous Diffusion Plant, TN). Jan 1981. NTIS, PC A20/MF A01.

From Energy conservation in design for UCCND managers and specialists meeting; Oak Ridge, TN, USA (18 Mar 1980).

The highlights of the power recovery studies to date seem to be: the use of a vapor driven turbine to recover and reapply the energy from the R-114 coolant system in each cell of the gaseous diffusion is quite feasible; no new technology is required for this application; the two main factors in evaluation of the program appear to be the economics and the level of equipment performance and operational reliability; and several hundred megawatts of power could be conserved when the combined three plants are at planned operating level. This is obviously a worthwhile goal for the diffusion plants and also for a national goal of energy conservation.

22238 **(DOE/CE/20167—05) Waste-to-energy compendium. Final report.** (National Center for Resource Recovery, Inc., Washington, DC (USA)). Apr 1981. Contract AC01-76CS20167. 125p. NTIS, PC A06/MF A01.

A survey is made of 35 waste-to-energy recovery projects throughout the US. Included are nine refuse-derived fuel (RDF) production facilities, six RDF user facilities, two combined RDF production-user facilities, and 18 mass burning facilities with energy recovery. Only those facilities that are fully operational or those in advanced stages of startup and shakedown are surveyed. Information is provided on processing capacities, operation and maintenance problems, equipment specifications, capital and operating costs, and the current status of each facility. In addition, process flow schematics are provided for each of the nine RDF production plants and both RDF production-user plants. Unless otherwise indicated, the data in this report have been updated to October or November, 1980.

22239 **(DOE/CS/40183—T1) Redesign of turbine-pump impeller and diffuser using hydrodynamic design techniques. Final report.** Hamrick, J.T. (Aerospace Research Corp., Roanoke, VA (USA)). Apr 1980. Contract AC01-78CS40183. 97p. (ORO—5127-1). NTIS, PC A05/MF A01.

It is indicated that in 1976 the average operating efficiency of well irrigation pumps in the US, including losses in the column pipe and line shaft, was 55.5%, but information is presented to show that losses in a pumping system can be reduced and that it is possible to reach a goal of 82% system efficiency. Hydrodynamic design methods which are used to analyze and modify a commercially available pump are presented. The results of tests with the pump are presented for which delivery losses were reduced by means of a packer at the pump and for which line shaft losses were reduced by means of a high strength line shaft. Methods of designing pumps that have a broader high efficiency range are explored, and a design approach for doing so is presented. The method was not evaluated experimentally. (MCW)

22240 **(DOE/ET/10415—T3) Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981.** Minnick, L.J. (Minnick (L. John), Plymouth Meeting, PA (USA)). 1981. Contract AC21-77ET10415. 27p. NTIS, PC A03/MF A01.

Research on potential uses of solid wastes from fluidized-bed combustion processes included the following activities during this quarterly report period: chemical analysis was performed on a pulverized coal fly ash that was proposed for use in the briquetting program; briquettes were evaluated by abrasion testing, incorporation into concrete mixes as the coarse aggregate, and by an examination of their crushing characteristics; the effects of carbonation of briquettes by exposure to $CO_2$ were studied; final data on the dimensional stability of test pads are presented; the wall constructed with AFB masonry block was monitored and additional compressive strengths of the block determined; waste sludge stabilization using AFB residue was tested and the results are reported; evaluation of crushed, stockpiled residue has continued; the qualitative review of the effects of molding moisture content on road base mixes has been completed; and preliminary results on the effects of combined storage of AFB residue and pulverized coal fly ash were obtained and are presented. (LCL)

22241 **(DOE/ET/12866—3) Residual energy applications program systems analysis report.** Yngve, P.W. (South Carolina Energy Research Inst., Columbia (USA)). Oct 1980. Contract AC09-77ET12866. 228p. NTIS, PC A11/MF A01.

Current DOE plans call for building an Energy Applied Systems Test (EAST) Facility at the Savannah River Plant in close proximity to the 140 to 150°F waste heat from one of several operating nuclear reactors. The waste water flow from each reactor, approximately 165,000 gpm, provides a unique opportunity to test the performance and operating characteristics of large-scale waste heat power generation and heat pump system concepts. This report provides a preliminary description of the potential end-use market, parametric data on heat pump and the power generation system technology, a preliminary listing of EAST Facility requirements, and an example of an integrated industrial park utilizing the technology to maximize economic pay back. The parametric heat pump analysis concluded that dual-fluid Rankine cycle heat pumps with capacities as high as 400 x $10^6$ Btu/h, can utilize large sources of low temperature residual heat to provide 300°F saturatd steam for an industrial park. The before tax return on investment for this concept is 36.2%. The analysis also concluded that smaller modular heat pumps could fulfill the same objective while sacrificing only a moderate rate of return. The parametric power generation analysis concluded that multi-pressure Rankine cycle systems not only are superior to single pressure systems, but can also be developed for large systems (≥ 17 MW/sub e/). This same technology is applicable to smaller systems at the sacrifice of higher investment per unit output.

22242 **(DOE/ET/15350—1) Generation of useful energy from process fluids using the Biphase turbine. Final report.** Helgeson, N.L. (Biphase Energy Systems, Santa Monica, CA (USA)). Jan 1981. Contract AC07-76ET15350. 213p. NTIS, PC A10/MF A01.

The six largest energy-consuming industries in the United States were surveyed to determine the energy savings that could result from applying the Biphase turbine to industrial process streams. A national potential energy savings of 58 million barrels of oil per year (technical market) has been identified. This energy is recoverable from flashing gas-liquid process streams and is separate and distinct from exhaust gas waste-heat recovery. The industries surveyed in this program were the petroleum chemical, primary metals, paper and pulp, stone-clay-glass, and food. It was required to determine the applicability of the Biphase turbine to flashing operations connnected with process streams, to determine the energy changes associated with these flashes if carried out in a Biphase turbine, and to determine the suitability (technical and economical feasibility) of applying the Biphase turbine to these processes. The results of this investigation are reported as: (1) a list of processes to which the Biphase turbine is adaptable, (2) a list of processes indicating the potential plant and national energy savings that could result from applying the Biphase turbine, (3) a list of the processes according to their suitability for application of the Biphase turbine. The results of energy calculations for 22 processes (out of 383 examined) are given. The process name, type of application, stream and plant size, energy savings per plant, and potential national energy savings(technical market) are provided for each entry. These processes are listed according to their national potential energy savings. Based upon these results a suitability listing was developed which rates the processes according to their technical and economic feasibility. In addition to the potential for energy savings, capital cost, payback period, estimated market penetration, and applicability of current Biphase technology were considered in the development of this listing.

22243 **(DOE/ET/15426—4) R and D for improved efficiency small steam turbines. Phase II. Second quarterly technical report.** (Northern Research and Engineering Corp., Woburn, MA (USA)). Mar 1981. Contract AC02-79ET15426. 82p. NTIS, PC A05/MF A01.

The detailed design of a radial inflow steam turbine (RIT) comprised of two radial inflow turbine stages driving a common bull gear/output shaft designed for rated speeds of 70,000 rpm and 52,500 rpm, respectively, is described. Details are presented on: aerodynamic design; high speed rotors; high speed rotor bearings; high speed rotor sealing; gearing; output shaft; static structure; and predicted performance. (MCW)

22244 **Resource recovery '80 presentation summaries.** Washington, DC; National Center for Resource Recovery, Inc. (1980). 30p. (CONF-801254—(Absts)).

From Resource recovery conference; Washington, DC, USA (12 Dec 1980).

Summaries of 6 papers are presented. Source Separation focuses on programs to separate recyclables from residential residuals. Energy and Materials Recovery briefly covers technologies for recovering energy and materials in solid wastes. Planning and Markets stresses that the key factor for resource recovery is in marketing the recovered products. The paper, Health and Safety, discusses dusts, explosion protection, health experiences, and air emissions and the current level of understanding of each measure. A number of examples of research areas is given in the paper, Research and Development, stressing what needs to be known or understood, why answers are needed, and what approaches are taken in analyses and experiments. A synthesis of the papers presented is given in Where Do We Stand. (MCW)

22245 **(NP—1902598) High temperature thermal insulation usage in UK process industries.** (Energy Technology Support Unit, Harwell (UK)). Nov 1980. 8p. NTIS (US Sales Only), PC A02/MF A01.

Required properties and usage of high temperature thermal insulation in UK process industries are briefly described. The main features of high temperature thermal insulation usage are described for the following industries: iron and steel; non-ferrous metals; cement; glass; pottery; brick and refractories. The energy conservation potential, barriers to wider use of high temperature insulation, and opportunities for research are discussed briefly. (MCW)

22246 **Michigan farm energy audit study: phase I.** Myers, C.A.; Stout, B.A.; Baas, D. (Michigan State Univ., East Lansing). Contract FG45-76CS60204. pp 45-49 of Agricultural energy. Vol. 1. Solar energy livestock production. St. Joseph, MI; American Society of Agricultural Engineers (1981).

From ASAE national energy symposium; Kansas City, MO, USA (29 Sep 1980).

Energy use on twelve farms in southern lower Michigan was studied in order to develop the reporting forms, procedures, computer programs, and expertise needed to audit a larger number of farms later. Results from the first year of study are shown. (MHR)

## 3206 Municipalities And Community Systems

*REFER ALSO TO CITATION(S) 21726, 21821, 22089, 22109, 22118, 22137, 22226, 22238, 22696*

22247 **(CONF-810565—1) Appropriate energy technology for urban areas.** Mixon, W.R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01.

From Workshop on status of research and methods of evaluation of appropriate technology of environmental interaction; Gainesville, FL, USA (14 May 1981).

Some of the unique characteristics of high density urban areas as they affect the potential use of energy conservation measures and more efficient and renewable energy sources are addressed. Energy-related problems of urban areas are presented and the inner city is characterized as an environment with limited potential for applying conservation measures and innovative energy sources at the level of individual buildings. District heating and cooling is presented as one technology, uniquely appropriate for urban areas, that can collect thermal energy from efficient cogeneration plants, municipal incinerators, industrial processes, and renewable natural energy resources and distribute that energy throughout a community to its ultimate consumers. Through district heating, the urban communities can conserve energy and scarce fuels, improve environmental quality, and participate in achieving a more harmonious interface between humanity and the natural environment.

**22248 (DOE/CS/60419—T1) Guide to reducing energy use...budget costs. Volume II. Local energy management program.** Brooks, S.O.; Wood, E.S.; Guenther, S.; Graves, T. (National Association of Counties Research, Inc., Washington, DC (USA). Energy Project; US Conference of Mayors, Washington, DC. Energy Program). Fal 1979. Contract FG01-78CS60419. 75p. NTIS, PC A04/MF A01.

Information is presented to aid communities tailor an energy conservation program specifically to themselves. Existing and new buildings, procurement, employee transportation programs, street lighting systems, and energy resource recovery are discussed. Examples are given on what can and has been done in communities. (MCW)

**22249 (DOE/IR/05106—T6) Status report on energy recovery from municipal solid waste: technologies, lessons and issues. Information bulletin of the energy task force of the urban consortium.** (Public Technology, Inc., Washington, DC (USA)). 1980. Contract FG02-78IR05106. 62p. NTIS, PC A04/MF A01.

A review is presented of the lessons learned and issues raised regarding the recovery of energy from solid wastes. The review focuses on technologies and issues significant to currently operating energy recovery systems in the US - waterwall incineration, modular incineration, refuse derived fuels systems, landfill gas recovery systems. Chapters are: Energy Recovery and Solid Waste Disposal; Energy Recovery Systems; Lessons in Energy Recovery; Issues in Energy Recovery. Some basic conclusions are presented concerning the state of the art of energy from waste. Plants in shakedown or under construction, along with technologies in the development stages, are briefly described. Sources of additional information and a bibliography are included. (MCW)

**22250 (DOE/IR/05106—T8) Local government guide to the emerging technologies of energy-efficient motors and heat pumps. Energy technology report of the energy task force of the urban consortium.** (Planning and Management Associates of Greater Washington, Inc., DC (USA); Public Technology, Inc., Washington, DC (USA)). 1980. Contract FG02-78IR05106. 39p. NTIS, PC A03/MF A01.

Information is presented to provide a local government manager with a basic background in energy efficient motors and heat pump technologies. An overview of each technology and the issues and considerations associated with their application are presented. Discussions cover installation and maintenance requirements, equipment availability, costs and risks/benefits. Data describing demonstration sites for solar assisted heat pump systems and contacts for further information are provided.

**22251 (DOE/TIC—1021175) Energy conservation manual for water & wastewater facilities.** (Wisconsin Univ., Madison (USA). Extension). Dec 1980. 134p. NTIS, PC A07/MF A01.

The manual is presented to provide water and waste-water managers with an overview of energy conservation activities in Wisconsin along with specific recommendations for improving their current programs. Chapters are: Energy Conservation Management; Water Supply System Energy Conservation; Waste Water Treatment System Energy Conservation; and General Measures for Energy Conservation. The appendices contain detailed information on energy audits along with papers relating to energy conservation and renewable energy sources. (MCW)

**22252 (DOE/TIC—1021874) Municipal energy conservation manual.** (Wisconsin Univ., Madison (USA). Extension). Jun 1979. 238p. NTIS, PC A11/MF A01.

A procedure for conducting an energy audit of an entire municipal government, including both its buildings and its various operations, is presented in the manual. The following topics are presented: energy conservation management; municipal buildings; standardize and regulate temperature; street lighting; motor vehicle energy conservation; waste water treatment plant of Marinette; equipment required for building energy audit; performing an energy audit; calculating heat losses; and audit notes and calculations. A table is included that illustrates that the highest energy use may have a much lower total cost than anticipated. Charts based on the cost and amount of energy used by Stevens Point and Marinette are given. Forms for use in the auditing process are provided in the appendices. (MCW)

**22253 (DOE/TIC—1022897) Energy conservation manual: a guide for regional planning commission assistance to small municipalities.** (Dane County Regional Planning Commission, Madison, WI (USA)). 1980. 47p. NTIS, PC A03/MF A01.

A management guide is presented for Regional Planning Commissions to provide assistance and coordination in addressing energy conservation issues. The process and experiences of the Dane County Regional Planning Commission in assisting member governments in their search for answers to energy conservation problems are described. The process is described in detail and the kinds of problems and difficulties which can occur along the way are noted. (MCW)

**22254 (NCEI—0024) Regional resource recovery feasibility study for Western Piedmont and Centralina Council of Governments.** (Henningson, Durham and Richardson, Inc., Charlotte, NC (USA)). 1 Feb 1981. 75p. NTIS.

A preliminary feasibility study was made to determine the resource recovery options open to the participating governments in the Western Piedmont and Centralina Council of Governments areas. Existing conditions, projections, markets, alternatives, and recommendations are discussed. (MCW)

**22255 (PNL—3719) Economics of power plant district and process heating in Richland, Washington.** Fassbender, L.L.; Bloomster, C.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 80p. NTIS, PC A05/MF A01.

The economic feasibility of utilizing hot water from nuclear reactors to provide district heating for private residences in Richland, Washington, and space and process heating for nearby offices, part of the Hanford Reservation, and the Lamb-Weston potato processing plant is assessed. Specifically, the practicality of using hot water from the Washington Public Power Supply System's WNP-1 reactor, which is currently under construction on the Hanford Reservation, just north of the City of Richland is established. World-wide experience with district heating systems and the advantages of using these systems are described. The GEOCITY computer model used to calculate district heating costs is described and the assumptions upon which the costs are based are presented. District heating costs for the city of Richland, process heating costs for the Lamb-Weston potato processing plant, district heating costs for the Horn Rapids triangle area, and process heating costs for the 300 and 3000 areas are discussed. An economic analysis is discussed and institutional restraints are summarized. (MCW)

**22256 (DOE/CS/20100—T2) Evaluation of mixing systems for biogasification of municipal solid waste.** Swartzbaugh, J.T.; Smith, R.B. (Systems Technology Corp., Xenia, OH (USA)). [nd]. Contract AC05-76CS20100. 79p. NTIS, PC A05/MF A01.

Two specially selected mixing systems were tested and evaluated to determine how effectively they could prevent the formation of fibrous mats and stringers during the anaerobic digestion of a slurried mixture of preprocessed municipal slide waste and sewage siudge to produce methane gas. The tests were conducted in a modified 10.7 m (35 ft) diameter, nominal 378,000 liter (100,000 gal) capacity concrete vessel in the Franklin, Ohio, environmental complex. This complex included two plants that collectively provided the solid waste/sewage sludge feedstock. One of the two mixing systems was a mechanical agitator--a vessel-centered rotary shaft with four blades at each of two levels to drive the slurry downward. The second system included three equidistantly placed gas gun assemblies that each produced bubbles at a constant rate to draw the slurry upward. The solids accumulations were generally the same for the two mixing systems when they had common test conditions. In all tests, the percent solids for the top level were higher than those for the middle and bottom levels. As the feed ratio and the percent solids in the feedstock were increased, this differential became progressively more pronounced. Moreover, the percent of volatile solids (in a given amount of total solids) for the

top level became disproportionately higher than those for the other two levels.

### 3209 Education And Public Relations

*REFER ALSO TO CITATION(S) 22103, 22178, 22179, 22180, 22181, 22182, 22183, 22184, 22185, 22186, 22187, 22188, 22189*

**22257 (DOE/TIC—1022079) Energy audit workbook: for local government and related agencies.** (Michigan Energy Administration, Lansing (USA)). Jan 1979. 39p. NTIS, PC A03/MF A01.

A workbook defining the energy audit and information on conducting and reporting an energy audit and selecting team members is presented. A guide to the energy management form, used to collect the data required, is included. Forms for recording information on the building profile, the energy audit, and certification are also included. (MCW)

**22258 (DOE/TIC—1022137) International Energy Conservation Month: an assessment.** (Department of Energy, Washington, DC (USA)). Nov 1979. 24p. NTIS, PC A02/MF A01.

Interviews were conducted to examine the impact of campaign promotional efforts for International Energy Conservation Month (IECM) on individual awareness and attitudes towards energy conservation. The methodology, promotional efforts for IECM, organizational responses, and questionnaires are presented. Data are analyzed on attitude items. (MCW)

## 33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

### 3301 Internal Combustion Engines

*REFER ALSO TO CITATION(S) 21582, 21999*

**22259 (SAND—81-8642) Experimental investigation into the application of spontaneous Raman scattering to spray measurements in an engine.** Johnston, S.C. (Sandia Labs., Livermore, CA (USA)). Apr 1981. Contract AC04-76DP00789. 14p. (CONF-810621—2). NTIS, PC A02/MF A01.

From Symposium on fluid mechanics of combustion systems; Boulder, CO, USA (22 Jun 1981).

The use of spontaneous Raman scattering as a laser probe for precombustion engine spray measurements has been investigated for a continuous-wave laser system. Topics of experimental importance such as spectroscopic distinction between the liquid and vapor phase of the fuel, spray fouling of windows, laser transmission through the spray, laser-droplet induced background, and others are discussed. A technique for vapor temperature measurement in precombustion, vaporizing fuel sprays was derived and applied. Mie scattering has been used to complement the Raman measurements. Results of the study indicate that vibrational Raman scattering alone cannot distinguish between liquid- and vapor-phase propane fuel, at least for the spectral resolution found to be most useful in engine mixing studies. However, when combined with the Mie scattering diagnostic, it was possible to distinguish between liquid and vapor regions and to make sensible, time-averaged number density measurements in the spray boundary. Inherent limitations of the continuous-wave experiment prevented separation of fuel number density measurements obtained in two-phase flow regions into a liquid and vapor phase contribution. Modifications to the experiment which would avoid this difficulty in thin-spray regions have been identified.

**22260 Soot reduction in diesel engines: a chemical approach.** Gaffney, J.; Sapienza, R.; Butcher, T.; Krishna, C.; Marlow, W.; O'Hare, T. (Brookhaven National Lab., Upton, NY). *Combustion Science and Technology :* **24**: 89-92(1980).

The systematic addition of alcohol to the fuel and the incorporation of a catalyst on the surface of a Cooperative Fuel Research (CFR) diesel combustion chamber significantly suppressed soot formation. These effects were additive under the experimental conditions with 40 to 80 percent soot reduction observed.

### 3303 Electric-powered Systems

**22261 (DOE/CS/54209—2) Vehicle test report: South Coast Technology electric cconversion of a Volkswagen Rabbit.** Price, T.W.; Shain, T.W.; Bryant, J.A. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Feb 1981. Contract AI01-78CS54209. 184p. NTIS, PC A09/MF A01.

The South Coast Technology Volkswagen Rabbit, an electric vehicle manufactured by South Coast Technology of Santa Barbara, California was tested at the Jet Propulsion Laboratory's (JPL) dynamometer facility in Pasadena and at JPL's Edwards Test Station (ETS) located near Lancaster, California. The tests were conducted between April and July, 1979. These tests were performed to characterize certain parameters of the South Coast Rabbit and to provide baseline data that will be used for the comparison of near-term batteries that are to be incorporated into the vehicle. The vehicle tests were concentrated on the electrical drive system; i.e., the batteries, controller, and motor. The tests included coastdowns to characterize the road load, maximum effort acceleration, and range evaluation for both cyclic constant speed conditions. A qualitative evaluation of the vehicle was made by comparing its constant speed range performance with those vehicles described in the document State of the Art assessment of Electric and Hybrid Vehicles. The Rabbit performance was near to the best of the 1977 vehicles.

**22262 Two-quadrant transistor chopper for electric vehicle drive.** Steigerwald, R.L. (GE, Schenectady, NY). *Conference Record, IAS (Industry Applications Society) Annual Meeting ;* No. 79CH1484-51A, 421-428(1979). (CONF-7910107—).

From IEEE-IAS conference on "electrostatics"; Cleveland, OH, USA (1 Oct 1979).

A two-quadrant dc-dc transistor converter capable of delivering 400 amperes motoring current and of generating 200 amperes braking current is described. The chopper operates from a 108-volt dc source and supplies the armature current of a separately excited dc machine in an electric vehicle application (3000-pound commuter-type vehicle). The chopper employs high current transistors specifically developed for the application. Snubber networks which reduce both turn-on and turn-off device stresses are employed. The interaction of the snubber networks for the motoring and braking transistors is described and design considerations presented. A technique is described which instantaneously detects a transistor failure and initiates appropriate action in order to prevent machine overcurrent and overtorque. Factors are discussed which are crucial to ensure proper transitions from motoring to braking and to inhibit device power dissipation due to parasitic currents. The selection of a variable frequency/variable pulse width switching strategy and protection and control techniques are discussed. 13 refs.

### 3306 Vehicle Design Factors

**22263 Automotive electronics.** London, England; Institution of Electrical Engineers (1979). 311p. (CONF-7910226—). Society of Automotive Engineers, Inc., Warrendale, PA.

From 2. international conference on automotive electronics; London, UK (29 Oct 1979).

Fifty-seven papers were presented at the conference on electronic monitoring and control devices for automotive vehicles. These devices include equipment for controlling engine operation, e.g., fuel-air ratio, ignition timing, fuel injection, transmission functions, vehicle lighting, tire pressure, safety equipment, cruise speed, etc. (LCL)

### 3307 Emission Control

*REFER ALSO TO CITATION(S) 22260*

### 3308 Alternative Fuels

*REFER ALSO TO CITATION(S) 21724, 21725*

## 36 MATERIALS

*REFER ALSO TO CITATION(S) 21653*

22264 **(LBL—12548) Nuclear materials progress reports for 1980.** Olander, D.R. (California Univ., Berkeley (USA)). Dec 1980. Contract W-7405-ENG-48. 66p. NTIS, PC A04/MF A01.

Separate abstracts were prepared for the 10 sections of this report. (DLC)

22265 **(UCID—19029) MAZE: an input generator for DYNA2D and NIKE2D.** Hallquist, J.O. (Lawrence Livermore National Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 78p. NTIS, PC A05/MF A01.

MAZE is a new interactive program that is being developed as an input generator for DYNA2D and NIKE2D; however, the generated mesh file is compatible with other finite element programs as well. The purpose of this report is to provide a preliminary user's manual. Since the development is not yet complete, users are invited and encouraged to make suggestions concerning any options of features that they would like added. Eventually, MAZE may become part of the DYNA2D and NIKE2D programs.

### 3601 Metals And Alloys

*REFER ALSO TO CITATION(S) 21511, 21936, 21991, 22090, 22417, 22926*

22266 **(CONS—5089-15) Production of aluminum-silicon alloy and ferrosilicon and commercial purity aluminum by the direct reduction process. First interim technical report, Phase D, January 1-March 31, 1981.** Bruno, M.J. (Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.). Apr 1981. Contract AC01-77CS40079. 64p. NTIS, PC A04/MF A01.

Operation of the bench AF-reactor on burden with all reducing carbon exterior to the ore pellet resulted in low metal alloy product yields and prematurely terminated runs, indicating the need for intimate contact between alumina and carbon to produce oxycarbide liquid prior to reaction with solid silicon carbide. Carbon solubility tests made on 60Al-40Si alloys at 2200°C in graphite crucibles indicated continued reaction to form SiC for one hour. Efficiency of reduction to SiC ranged from 68 to 100%. The A-C two-electrode submerged arc reactor pilot, SAR-II, was successfully operated on both alumina-clay-coke and alumina-silicon carbide-coke (from the VSR prereduction) burdens. Metal alloy was produced and tapped in each of four runs. The pilot crystallizer was operated to evalute the two-stage (stop and go) crystallization technique on obtaining high yields of Al in Al-Si eutectic, with a limit of 1.0% Fe and 0.1% Ti in the alloy product. 18 figures, 19 tables. (DLC)

22267 **(DOE/CS/40284—T1) Assessment of the magnesium primary production technology. Final report.** Flemings, M.C.; Kenney, G.B.; Sadoway, D.R.; Clark, J.P.; Szekely, J. (Massachusetts Inst. of Tech., Cambridge (USA)). 1 Feb 1981. Contract AC01-76CS40284. 180p. NTIS, PC A09/MF A01.

At current production levels, direct energy savings achievable in primary magnesium production are 1.2 milliquads of energy per annum. Were magnesium to penetrate the automotive market to an average level of 50 pounds per vehicle, the resultant energy savings at the production stage would be somewhat larger, but the resulting savings in gasoline would conserve an estimated 325 milliquads of energy per year. The principal barrier to more widespread use of magnesium in the immediate future is its price. A price reduction of magnesium of 10% would lead to widespread conversion of aluminum die and permanent mold castings to magnesium. This report addresses the technology of electrolytic and thermic magnesium production and the economics of expanded magnesium production and use.

22268 **(DOE/ER/01198—1352) Tunneling of mixed dumbbells in Al-Zn.** Hultman, K.L.; Holder, J.; Granato, A.V. (Illinois Univ., Urbana (USA)). 1981. Contract AC02-76ER01198. 4p. (CONF-810717—1). NTIS, PC A02/MF A01.

From International conference on internal friction and ultrasonic attenuation in solids; Lausanne, Switzerland (Jul 1981).

Evidence for the caged mixed dumbbell configuration for the interstitial impurity complex is obtained from the polarization and annealing dependence of the ultrasonic diaelastic and paraelastic response in irradiated aluminum with zinc impurities. From the temperature dependence of the relaxation time, it can be deduced that the complex tunnels between equivalent configurations.

22269 **(DOE/ET/26214—T1) Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979.** Mucci, J. (Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.). May 1980. Contract AC02-77ET26214. 85p. (COO—4355-11). NTIS, PC A05/MF A01.

This program was established to determine the feasibility of laser beam welding as a fabrication method for hydrogen transmission and is a precursor in the effort to systematically provide the technological base necessary for large-scale, economic pipeline transmission of fuel for a hydrogen energy system. The study contributes to the technology base by establishing the effect of conventional weld processes and laser beam welding on the mechanical properties of two classes of steels in an air and high pressure gaseous hydrogen environment. Screening evaluation of the tensile, low-cycle fatigue and fracture toughness properties and metallurgical analyses provide the basis for concluding that laser beam welding of AISI 304L stainless steel and ASTM A106B carbon steel can produce weldments of comparable quality to those produced by gas-tungsten arc and electron beam welding and is at least equally compatible with 13.8 MPa (2000 psig) gaseous hydrogen environment.

22270 **(DOE/ET/52039—2) Hydrogen in titanium alloys.** Wille, G.W.; Davis, J.W. (McDonnell Douglas Astronautics Co., St. Louis, MO (USA)). Apr 1981. Contract AS02-77ET52039. 54p. NTIS, PC A04/MF A01.

The titanium alloys that offer properties worthy of consideration for fusion reactors are Ti-6Al-4V, Ti-6Al-2Sn-4Zr-2Mo-Si (Ti-6242S) and Ti-5Al-6Sn-2Zr-1Mo-Si (Ti-5621S). The Ti-6242S and Ti-5621S are being considered because of their high creep resistance at elevated temperatures of 500°C. Also, irradiation tests on these alloys have shown irradiation creep properties comparable to 20% cold worked 316 stainless steel. These alloys would be susceptible to slow strain rate embrittlement if sufficient hydrogen concentrations are obtained. Concentrations greater than 250 to 500 wppm hydrogen and temperatures lower than 100 to 150°C are approximate threshold conditions for detrimental effects on tensile properties. Indications are that at the elevated temperature - low hydrogen pressure conditions of the reactors, there would be negligible hydrogen embrittlement.

22271 **(DOE/OR/05951—T1) Combined thermodynamic study of nickel-base alloys. Progress report.** Brooks, C.R.; Meschter, P.J. (Tennessee Univ., Knoxville (USA). Dept. of Chemical, Metallurgical and Polymer Engineering). 15 Feb 1981. Contract AS05-78OR05951. 43p. NTIS, PC A03/MF A01.

Achievements during this period are the following: (1) initiation of a high-temperature study of the Ni-Ta system using the galvanic cell technique, (2) emf study of high-temperature thermodynamics in the Ni-Mo system, (3) measured heat capacity data on ordered and disordered $Ni_4Mo$, (4) heat capacities of Ni and disordered $Ni_3Fe$, and (5) computer correlation of thermodynamic and phase diagram data in binary Ni-base alloys. (MOW)

**22272 Defect clustering in copper, silver and aluminium during heavy-ion irradiations at low temperatures.** Averback, E.S.; Merkle, K.L.; Thompson, L.J. (Argonne National Lab., IL (USA)). *Radiation Effects ;* **51**: No. 1-2, 91-102(Jul 1980).

Point defect clustering during heavy-ion irradiation at low temperature was investigated in copper, silver, and aluminum using electrical-resistivity measurements. Clustering effects were studied by determining the average recombination volume per Frenkel defect, V bar, as a function of defect concentration. Within single unoverlapped displacement cascades, the clustering increased with increased energy density in the cascades. For Ar-irradiated aluminum no clustering was observed in individual cascades, whereas for Kr-irradiated silver V bar was deduced to be approximately 0.2 $V_0$, where $V_0$ is the value of V bar for unclustered defects. Clustering was observed for all ion-target combinations at sufficiently high dose. For copper and silver at high doses, a regime was reached in which additional irradiation increased the Frenkel defect number N without increasing the total recombination in volume NV bar. Defect clustering in copper and silver during isochronal annealing of damage produced by 150-keV proton irradiation was investigated by the same method.

**22273 (LA-UR—81-1400) Evaluation of molybdenum and its alloys.** Lundberg, L.B. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 10p. (CONF-810614—5). NTIS, PC A02/MF A01.

From 16. thermophysics conference; Palo Alto, CA, USA (23 Jun 1981).

The choice of pure molybdenum as the prime candidate material for space reactor core heat pipes is critically examined. Pure molybdenum's high ductile-brittle transition temperature appears to be its major disadvantage. The candidate materials examined in detail for this application include low carbon arc-cast molybdenum, TZM-molybdenum alloy, and molybdenum-rhenium alloys. Published engineering properties are collected and compared, and it appears that Mo-Re alloys with 10 to 15% rhenium offer the best combination. Hardware is presently being made from electron beam melted Mo-13Re to test this conclusion.

**22274** (LBL—12548, pp 1-5) **Stress corrosion cracking of zircaloy by metal iodides and cadmium.** Shann, S.H. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

$I_2$, $FeI_2$, Cd, and $AlI_3$ were found to be stress corrosion cracking agents for Zircaloy, but CsI was not. (DLC)

**22275** (LBL—12548, pp 62-63) **Molecular beam studies of atomic hydrogen reduction of refractory oxides.** Dooley, D.F. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

The modulated molecular beam study of the reduction reactions of thermal atomic hydrogen with $UO_2$ and $Al_2O_3$ was continued. (DLC)

**22276 Mechanistic model for time-dependent fatigue.** Majumdar, S.; Maiya, P.S. (Argonne National Lab., IL). *Journal of Engineering Materials and Technology ;* **102**: 159-167(Jan 1980).

Elevated-temperature failure of structural materials (e.g., austenitic stainless steels, low-alloy steels) used in energy-conversion systems can occur by fatigue, creep, or by interactive processes involving creep, fatigue, and environment. The fracture surfaces of these materials exhibit a variety of microstructural features depending upon the type of material, strain rate, temperature, environment, hold times, and sequence of waveshapes. These microstructural observations have been used as a guide in the formulation of generalized damage-rate equations that include interaction between a crack and cavities in a given environment. Crack-propagation rate as well as total life of a fatigue specimen have been calculated by integrating the damage-rate equations over the inelastic strain history of the specimen, and compared with experimental results.

**22277 (RFP—3049) Fabricating tungsten crucibles by drawing and extrusion spinning.** Edstrom, C.M. (Rockwell International Corp., Golden, CO (USA). Energy Systems Group). 25 Apr 1981. Contract AC04-76DP03533. 11p. NTIS, PC A02/MF A01.

The fabrication of seamless tungsten crucibles 127-mm ID x 265-mm high x 6.25-mm wall thickness (5 in. x 10 1/2 in. x 1/4 in.) involved three drawing operations and extrusion spinning. The success of the drawing operations came from a combination of low draw reduction percentage, generous draw radii, large punch-to-die clearance, and attention to drawing temperature. The extrusion spinning success related to good drawn-cup-to-spinning-mandrel fit prior to making the extrusion passes, removal of stress risers in the part prior to spinning, and special attention to part and mandrel temperature.

**22278 (SAND—81-0147C) Quantitative x-ray microanalysis of U-Nb alloys with the scanning transmission electron microscope.** Romig, A.D. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 27p. (CONF-810705—3). NTIS, PC A03/MF A01.

From 16. annual conference of the Microbeam Analysis Society; Vail, CO, USA (13 Jul 1981).

The transmission electron microscope (TEM) and scanning transmission electron microscope (STEM) are currently being used to study phase transformations in uranium rich U-Nb alloys. To perform quantitative STEM X-ray microanalysis successfully, several problems must be solved. One problem is sample preparation since these alloys react strongly to most chemical solutions and oxidize readily in air. In addition, the high average atomic number of this material requires characterization of electron penetration, X-ray absorption, and electron beam spreading within the foil. It is the objective of this paper to describe the techniques developed to enable quantitative X-ray microanalysis on these alloys. Included are the experimental determination of the Cliff-Lorimer K/sub NbU/ factor at 100 and 200 kV and an examination of the limitations of this analysis technique, including X-ray spatial resolution and X-ray absorption, as applied to U-Nb alloys.

**22279 (SAND—81-0558C) Pressure-induced change in the Fermi surface and electronic structure of metals.** Schirber, J.E. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810640—1). NTIS, PC A02/MF A01.

From 17. State-of-the-art symposium; Washington, DC, USA (8 Jun 1981).

Hydrostatic pressure coupled with temperatures near absolute zero has proven to be an extremely important environment in the study of the Fermi surface and electronic structure of metals. This environment allows critical testing of theoretical models for the electronic structure and allows access to regions of the phase diagram of the material where interesting and desirable properties may be isolated and studied.

**22280 Laser production of supersonic metal cluster beams.** Dietz, T.G.; Duncan, M.A.; Powers, D.E.; Smalley, R.E. (Rice Quantum Institute and Department of Chemistry, Rice University, Houston, Texas 77001). *Journal of Chemical Physics, The ;* **74**: No. 11, 6511-6512(1 Jun 1981).

Cold beams of metal clusters are produced by combining a laser vaporization technique with pulsed supersonic nozzle technology. (AIP)

**22281 3d—4p transitions in the zinclike and copperlike ions Y X, XI; Zr XI, XII; Nb XII, XIII; and Mo XIII, XIV.** Wyart, J.; Reader, J.; Ryabtsev, A. (National Bureau of Standards, Washington, D.C. 20234). *Journal of the Optical Society of America ;* **71**: No. 6, 692-698(Jun 1981).

Lines occurring as satellites on the long-wavelength side of the $3d^{10}$—$3d^94p$ resonance lines of Ni-like ions have been investigated with a low-inductance vacuum spark and a 10.7-m spectrograph for the elements Y, Zr, Nb, and Mo. The lines are interpreted as $3d^{10}4s$—$3d^94s4p$ and $3d^{10}4p$—$3d^94p^2$ transitions in the Cu-like ions Y XI, Zr XII, Nb XIII, and Mo XIV and $3d^{10}4s^2$—$3d^94s^24p$ transitions in the Zn-like ions Y X, Zr XI, Nb XII, and Mo XIII. The spectra of the Cu-like ions were interpreted by gen-

eralized least-squares fits for the energy levels of the sequence of four ions. Thirty-nine levels of $3d^9 4s4p$ were interpreted simultaneously with a root-mean-square deviation of 122 $cm^{-1}$; forty-four levels of $3d^9 4p^2$ were interpreted in the same way with a root-mean-square deviation of 20 $cm^{-1}$. Line identifications and energy levels were obtained for the $3d^{10}7p$ configuration of the Cu-like ions Y XI—Mo XIV.

**22282 Particle size measurements using an optical variable-frequency-grid technique.** Wang, J.C.F.; Tichenor, D.A. (Sandia National Laboratories, Livermore, California 94550). *Applied Optics ;* **20**: No. 8, 1367-1373(15 Apr 1981).

A fringe visibility method for sizing particles 10 mm and larger has been developed. As the image of a particle scans across a variable frequency grid, the transmitted light signal oscillates with varying visibility. The visibility goes through a null at a well-defined point where the particle diameter approximates the local grid spacing. Several optical arrangements implementing the variable frequency grid technique have been tested. Using classified alumina and pulverized coal particles we obtained good agreement between size distributions measured by this technique and those from a commercial off-line analyzer. However, our optical arrangement and signal processing techniques require further development to reduce them to practice.

**22283 Optical properties of metals.** Weaver, J.H.; Krafka, C.; Lynch, D.W.; Koch, E.E. (University of Wisconsin, Synchrotron Radiation Center, Stoughton, Wisconsin 53589). OBES-W7405-ENG-82. *Applied Optics ;* **20**: No. 7, 1124-1125(1 Apr 1981).

Attention is drawn to a forthcoming publication of optical data on all the metallic elements in the photon energy range 0.1—500 eV. (AIP)

**22284 (NE-M—2-6T(4-81)(Rev.)) Martensitic stainless steel (Type 403) forgings (ASME SA-182 with additional requirements).** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Apr 1981. 10p. Nuclear Standards Management Center, Oak Ridge, TN.

This standard covers martensitic stainless steel (type 403 modified) forgings for nuclear and associated applications.

**22285 Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy.** Steinbruechel, C.; Gruen, D. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 235-237(Mar 1981).

Matrix isolation spectroscopy is used to investigate the sputtering of several metal surfaces and of $TiO_2$. The sputtered species are collected in a cryogenic noble gas matrix, and their identities and amounts are established from optical absorption spectroscopy. The technique is sensitive enough to allow the measurement of sputtering yields as low as 0.01. Furthermore, it provides for essentially simultaneous detection of neutrals and ions using the same sputtering and collection geometry. Thus, with known detection sensitivities for ions and neutrals, absolute values for sputtered ion fractions can be obtained. Data will be presented for Ti, Zr, Mo, V, and $TiO_2$ bombarded by low energy (~2 keV) $Ar^+$, $O_2^+$, and $N_2^+$, and will be compared with various models for calculating sputtering yields.

**22286 Enhanced interdiffusion of Cu into rf-sputtered chromium oxide films.** Krishnaswamy, S.V.; Tongson, L.L.; Said, N.; Messier, R. (Materials Research Laboratory, Pennsylvania State University, University Park, Pennsylvania 16802). EM-78-C-04-5302. *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 401-404(Mar 1981).

The interdiffusion behavior of chromium oxide films rf-sputtered in $O_2$ ambient onto substrates of bulk Cu as well as ~100 nm thin films of Cu was studied using Auger electron and ion scattering spectrometries. Composition depth profiling was carried out for films deposited on substrates which were untreated, thermally oxidized, and plasma oxidized and had other surface pretreatments. Interdiffusion of $Cr_2O_3$ films with bulk and thin film Cu substrates is observed even in the unannealed samples and increases with annealing treatment. Essentially complete intermixing of Cu and Cr occurred upon annealing at 150°C for the $Cr_2O_3$/Cu film couple. Such layers are potential selective solar absorber coatings.

**22287 Two-dimensional chemisorbed phases.** Roelofs, L.D.; Kortan, A.R.; Einstein, T.L.; Park, R.L. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). DE-AS05-79ER-10427. *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 492-499(Mar 1981).

Chemisorbed atoms on single-crystal metal surfaces frequently form commensurate diperiodic structures because of the strong, site-specific binding. Since the adatoms are well described by the lattice gas model, these systems are valuable testing grounds for recent theories of two-dimensional critical phenomena. We review briefly the developments in this field, emphasizing our results for the system O/Ni(111). This study includes an analysis of the multicritical low-coverage phase diagram, Monte Carlo simulations of the overlayer, and the first measurement of critical exponents for a phase transition in a chemisorbed overlayer probed via low energy electron diffraction. We compare our results with predictions of various two-dimensional models.

**22288 Surface segregation and surface electronic structure of PtCu alloys: Dependence on atomic coordination.** Shek, M.L.; Stefan, P.M.; Weissman-Wenocur, D.L.; Pate, B.B.; Lindau, I.; Spicer, W.E. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305). *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 533-536(Mar 1981).

Ultraviolet photoemission experiments have been performed on the (110) and (111) single crystal surfaces of PtCu alloy. The difference in their surface atomic arrangements gives rise to different peak shapes in the Cu 3d-derived surface "density of states". The PtCu (110) sample, with 1.9—2.3 at. % Cu in the bulk, shows 5.6%—7.7% Cu near the surface. The PtCu(111) sample, in comparison, shows insignificant Cu surface segregation.

**22289 Thermal desorption and UPS study of CO adsorbed on Cu-covered Ru (0001).** Richter, L.; Bader, S.D.; Brodsky, M.B. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). W-31-109-ENG-38. *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 578-580(Mar 1981).

We have studied the electronic structure and chemisorption properties of (0—4) monolayers of Cu evaporated on a Ru (0001) single crystal substrate. HeI UPS shows that the Cu d band initially (0—1.5 monolayers) forms as an asymmetric resonance of 0.75 eV half width, 2.75 eV below E/sub F/. When the Cu coverage is increased, the resonance broadens and shifts nearer E/sub F/ until a bulk (111) Cu spectrum is attained at 4.0 monolayers [Cu(111) forms on Ru(0001)]. Thermal desorption of CO from the Cu overlayers shows that CO is more strongly bound to the first layer of Cu(≈15 kcal/mol) than to the second and succeeding layers of Cu [≈12 kcal/mol typical of bulk (111) Cu]. There is also evidence that more CO adsorbs on the first layer of Cu than adsorbs on bulk (111) Cu.

**22290 Chemisorption—corrosion transition: The role of surface impurities as markers for evaluating the transition.** Windawi, H. (Center for Catalytic Science and Technology, Department of Chemical Engineering, University of Delaware, Newark, Delaware 19711). *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 660-662(Mar 1981).

The transition from chemisoption to corrosion, such as in the oxidation of metal surfaces, has received little attention in comparison to both chemisorption and corrosion. This is mainly due to the high rate at which the transition takes place and the experimental difficulties arising from alteration of the rate by the probing techniques. It is proposed that surface impurity adlayers can become markers for probing the transition. The effect of sulfur adlayer on the initiation of nickel oxide is investigated. Surface reactions associated with the oxidative dosing of sulfur-covered surfaces were studied; surface compositions were analysed by AES and gas-phase constituents were measured by quadrupole mass spectrometry.

**22291 Fluctuation heat capacity of amorphous $Nb_3Ge$ films.** Rao, N.A.H.K.; Goldman, A.M. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota). DE-ACOZ-ERO-1569.M0003. *Journal of Low Temperature Physics ;* **42**: No. 3, 253-276(1 Feb 1981).

The temperature dependencies of the heat capacities of amorphous $Nb_3Ge$ films have been measured near the superconducting transition using ac calorimetry. From an analysis of data both above and below, but outside, the transition region, a transition temperature T/sub BCS/ was uniquely determined. The departure of the measured heat capacity from the BCS theory below the transition and from the usual sum of lattice and electronic terms above was then extracted. Above T/sub BCS/, over a substantial temperature range, the departure could be attributed to fluctuations and could be fit with a two-dimensional free fluctuation theory modified to take into account the fact that film thicknesses, which were on the order of 1000 A, were not always small in comparison with the temperature-dependent coherence length. However, the transition temperature obtained from such a fit was always found to be higher than T/sub BCS/ determined from data outside the transition region. Furthermore, below T/sub BCS/ a broad bump in the excess heat capacity was observed. A quantitative description of the excess heat capacity data may require the development of a theory based on the two-component Ginzburg—Landau model which treats the quartic term in a more realistic manner than in the Hartree model, and which takes into account both thickness corrections in films with a small natural j(0) and the possibility of quenched or frozen-in disorder.

**22292 Vapor pressure and thermodynamics of actinide metals.** Ward, J.W. (Los Alamos Scientific Lab., NM); Kleinschmidt, P.D.; Haire, R.G.; Brown, D. *ACS (American Chemical Society) Symposium Series ;* No. 131, 199-220(1980). (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

Precise vapor pressure measurements by target collection/mass spectrometric Knudsen effusion techniques were combined with crystal entropy estimates to produce self-consistent free-energy functions, permitting calculation of heats, entropies and free energies from 298 K to the highest temperatures of measurement. The vapor pressures and thermodynamics of vaporization of americium, curium, berkelium, and californium are compared in terms of electronic structure and bonding trends in the transplutonium elements. These results are contrasted with the behavior of the early actinides, with attention to energy states and possible effects of f-electron bonding. 9 figures, 4 tables.

**22293 (UCRL-Trans—11676) Galvanic deposition of superinvar alloys.** Alberth, W.; Bogenshutz, A.F.; Jostan, J.L.; Von Krusenstjern, A. Translated from *Galvanotechnik ;* **66**: No. 4, 291-300(1975). 19p. NTIS, PC A02/MF A01.

The described galvanic method for depositing cylindrical superinvar hollow bodies is based on the use of a chloride-containing sulfate electrolyte and uses soluble iron, nickel and cobalt anodes, with a cathode current density of 10 $A/dm^2$. The metal content of the electrolyte is about 100 g/l, the working temperature is 55°C and the deposition rate is about 2.5 μm/min. The chemical composition of the ternary alloys was varied in the range 66 to 76 wt % Fe, 24 to 30 wt % Ni and 0 to 6 wt % Co and included the desired superinvar alloy having 65 wt % Fe, 30 wt % Ni and 0 to 6 wt % Co, which is characterized by a very low linear expansion coefficient. For the galvanically produced alloy with 66.4 wt % Fe, 29 wt % Ni and 4.6 wt % Co, this value is $< 2.87.10^{-6}/°C$ after a thermal treatment and quenching treatment (in a temperature range 0 to 100°C). Therefore, it is at least smaller by a factor of 1.3 than for binary invar alloys which were deposited galvanically. In both cases, due to electrocrystallization, we did not achieve the low expansion coefficients exactly as are known from invar and superinvar alloys produced by metallurgical melting.

## 3602 Ceramics, Cermets, And Refractories

*REFER ALSO TO CITATION(S) 21497, 21644, 21644, 21663, 21663, 21663, 21664, 21664, 21664, 21999, 21999, 22029, 22029, 22036, 22091, 22149, 22285, 22286*

**22294** (CONF-8005107—, pp 44-57) **Hydrothermal interaction of a ceramic waste form with basalt.** Scheetz, B.E.; Komarneni, S.; Smith, D.K.; Anderson, C.A.F. (Pennsylvania State Univ., University Park). Apr 1981. NTIS, PC A17/MF A01.

From Alternate waste form information workshop; Gatlinburg, TN, USA (13 May 1980).

The behavior of crystalline supercalcine-ceramic in the presence of basalt was investigated under mild hydrothermal conditions at 100, 200, and 300°C with a pressure of 300 bars. Both the solid phases and solution concentrations of the interaction products of basalt and supercalcine-ceramic were characterized. At 100°C, no alteration products could be detected in experiments involving supercalcine-ceramic and basalt. The solution analyses for elements specific to the supercalcine-ceramic did not indicate any significant differences between the treatments with and without basalt, suggesting little or no interaction between basalt and supercalcine-ceramic at this temperature. At 300°C, several solid alteration/interaction products were identified. These products included two phases, pollucite and scheelite, originally incorporated into the ceramic formulation but which reformed with different bulk chemical compositions. In addition, isolated crystals of unidentified K (+-Ba) aluminosilicate phases were observed. Solution analyses of these runs did not indicate any significant differences between the treatments of supercalcine-ceramic with and without basalt, except that the Sr concentration decreased in the presence of basalt. Similar behavior was noted earlier, when basalt and $SrZrO_3$ experiments were conducted. Alteration products and solution concentrations at 200°C lie intermediate between the 100° and 300°C results.

**22295 (DOE/ER/10438—T1) Critical conditions for the growth of SiC, $Si_3N_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981.** Smith, F.W. (City Coll., New York (USA). Dept. of Physics). Jan 1981. Contract AS02-79ER10438. 12p. (COO—10438-3). NTIS, PC A02/MF A01.

The uhv system in use for Si surface reaction studies is described and experimental results obtained during the last year using this system are presented.

**22296 (DOE/OR/20679—T4) High temperature applications of structural ceramics. Quarterly progress report, January-March 1981.** Schneider, S.J. (National Bureau of Standards, Washington, DC (USA). Center for Materials Science). 1981. Contract AI05-80OR20679. 9p. NTIS, PC A02/MF A01.

High temperature four point bending tests under constant displacement rate conditions have been performed on several SiC and Si-Al-O-N specimens. Microstructure and fracture studies are also underway. (MOW)

**22297** (LBL—12548, pp 6-10) **Point defects in uranium dioxide.** Kim, K.C. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

The tracer diffusion coefficient of oxygen in UO/sub 2-x/ was measured using a diffusion couple and $^{18}O$. At 1400°C, the contributions of vacancies and interstitials to the oxygen diffusion coefficient in stoichiometric $UO_2$ are about equal. The Frenkel energy and entropy agree with Szwarc's theory. A band gap of 2.0 eV and an effective mass of 7.6 m/sub e/ were obtained. (DLC)

**22298** (LBL—12548, pp 20-34) **Kinetics of laser pulse vaporization of $UO_2$.** Tsai, C.H. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

Knudsen cell experiments were used to obtain ionization cross sections and fragmentation patterns, which were compared with those of Blackburn and Pattoret. Computer simulation of transient laser vaporization and of the first wall design of the Inertial Confinement Fusion concept is discussed. 7 figures. (DLC)

22299 (LBL—12548, pp 35-40) **Study of the kinetics of UC vaporization at temperatures above melting point using laser heating technique.** Tehranian, F. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

The laser technique is being used to measure the vapor pressure of UC up to 5000°K. Details of the experimental method, including the laser pulse characteristics, are given. 3 figures. (DLC)

22300 (LBL—12548, pp 41-46) **Release of water vapor from uranium dioxide.** Sherman, D. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

$UO_2$ was exposed to $D_2O$ under conditions simulating physical adsorption of water vapor and retention of water vapor during sintering. The release rate data suggest that water retained by $UO_2$ during the sintering process contains a major component bound with an energy of ~ 25 kcal/mole, and smaller components with binding energies of ~ 40 and 53 kcal/mole. (DLC)

22301 (LBL—12548, pp 47-52) **Redistribution of ruthenium in $UO_2$ in a temperature gradient.** Zhou, S.Y. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

$UO_2$ powders were mixed with Ru powders and sintered. Results showed that large amounts of Ru diffused up the temperature gradient and accumulated at the hot ends. An isothermal anneal at 2470°K did not change the Ru distribution. (DLC)

22302 (LBL—12548, pp 58-61) **Tracer surface diffusion on $UO_2$.** Olander, D.R. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

Analysis of surface spreading data yields a surface diffusivity between 0.1 and 0.2 $cm^2/s$ at 1915°C. (DLC)

22303 **Moessbauer characterization of reactively sputtered iron nitride films.** Lo, C.; Krishnaswamy, S.V.; Messier, R.; Rao, K.R.P.M.; Mulay, L.N. (Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802). DE-AC-22-79PC 1035. *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 313-317(Mar 1981).

We have shown by Moessbuaer spectroscopy and x-ray diffraction that single-phase, small crystallite size films in the Fe—N system (g'-$Fe_4N$ and $Fe_3N$) can be synthesized by varying reactive sputtering conditions in $Ar+N_2$ gas mixtures. The g'-$Fe_4N$ phase can be further produced and controlled by addition of $H_2$ to the sputtering gas with single phase films (i.e., no unreacted a-Fe present) obtained only at a 1:3 $N_2$:$H_2$ mixture. The film microstructures are consistent with the structure zone model classification scheme and show that faceted, high surface area, single phase g'-$Fe_4N$ and $Fe_3N$ films can be prepared with crystallite sizes of ~400—500 A.

22304 **Comments on '30 K fast neutron and fission fragment irradiations of two Fe-B type amorphous alloys'.** Birtcher, R.C.; Blewitt, T.H. (Argonne National Lab., IL (USA)). *Radiation Effects Letters ;* **57**: No. 1-2, 33-36(May 1980).

Reference is made to recently reported results of fast-neutron and $^{235}U$ fission fragment irradiations of two amorphous alloys, $Fe_{80}B_{20}$ and $Fe_{78}Mo_2B_{20}$. Reasons are advanced for suggesting that, during the 'fast'-neutron irradiation, the resistivity changes may have primarily been due to the isolated Frenkel pairs produced by the $^{10}B(n,\alpha)$ reaction, while during the $^{235}U$ fission-fragment irradiation the resistivity changes may have primarily been due to the disordering produced by the displacement cascades.

## 3603 Composite Materials

22305 **(DOE/DP/40094—T1) Final report on research on optical coatings.** Haller, W.; Sanders, D.M.; Farabaugh, E.N. (National Bureau of Standards, Washington, DC (USA)). 13 Jan 1981. Contract AI08-79DP40094. 17p. NTIS, PC A02/MF A01.

The construction of an apparatus designed to prepare thin films by physical vapor codeposition is described. This apparatus permits the characterization of the substrate prior to deposition using electron spectroscopy for chemical analysis, auger electron spectroscopy, secondary ion mass spectroscopy, and ion scattering spectroscopy. The system permits deposition of thin films by resistively heated boats and electron beam evaporation sources which can be operated simultaneously. The resulting films can be characterized using the above surface analysis techniques without exposure to the atmosphere using a transfer mechanism described in the report.

22306 **(UCRL—52434(Vol.8)) Development of alternate silicone potting compounds. Volume 8. Development of an alternate substitute for Dow Corning aerospace sealant DC93-122 based on Sylgard 184 and dielectric gel Q3-6527.** Cady, W.E.; Buckner, A.T. (Lawrence Livermore National Lab., CA (USA)). 9 Feb 1981. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01.

A second substitute was formulated for Dow Corning DC93-122 silicone potting compound because the first substitute proved so strong and hard. The second substitute was made weaker by substituting Sylgard 184 for Sylgard 186 and by adding dielectric gel Q3-6527. Accelerator QCF3-6559, DC1107 fluid, and Cabosil Grade MS75 silicon dioxide were still required. To reduce the porosity of the potting, the amount of DC1107 fluid in the formulation was minimized, which required adding a relatively large amount of accelerator (as was done in the first substitute). Dielectric gel Q3-6527 used alone required considerably less silicon dioxide to achieve a non-flow state than did Sylgard 184 or any of its blends with Q3-6527.

22307 **Catalytic effect of a Portland cement filler on the cure of water-compatible resorcinol phenol-formaldehyde polymer concrete.** Sugama, T.; Kukacka, L.E.; Horn, W. (Brookhaven National Lab., Upton, NY). *Journal of Applied Polymer Science ;* **26**: No. 5, 1453-1463(May 1981).

Aggregate with a water content < 1 wt % is normally needed for the production of polymer concrete (PC). This increases the cost and complexity of the process. In this study, PC with a compressive strength of > 2000 psi (> 13.78 MPa) at age of 1 h at 24°C was produced by mixing resorcinol phenol-formaldehyde (RPF) resin with portland cement and aggregate containing 1 to 10% water. The addition of ~ 14.7 to 17.5% type III portland cement to the PC formulation produced an acceleration in the rate of the condensation-type polymerization reaction and improved the properties of the composite. The cause of the accelerative effect was found to be the electropositive bivalent metallic ions of calcium and magnesium released from the cement grains in an aqueous medium. Conversely, the trivalent metallic ions from cement such as $Al^{3+}$ and $Fe^{3+}$ have no effect on the rate of polymerization of RPF resin.

## 3604 Polymers And Plastics

*REFER ALSO TO CITATION(S) 21574, 22404*

22308 **Effects of ionizing radiation on perfluorosulfonic acid ion-exchange polymer.** Balko, E.N.; Chaklos, J.T. (General Electric Co., Wilmington, MA). *Journal of Applied Polymer Science ;* **26**: No. 5, 1519-1531(May 1981).

The effects of $\beta$ and $\gamma$ radiation on the Nafion perfluorinated ion-exchange polymer have been examined and the radiolysis products have been identified. The polymer degrades by simple chain scission, and the rate of degradation is not affected by the state of polymer hydration or the nature of the ion which occupies an exchange site.

22309 **Polymeric mandrels: supersmooth finish by an infusion process.** Duchane, D.V. (Los Alamos Scientific Laboratory, P.O.Box 1663 Los Alamos, New Mexico 87545). W-7405-ENG-36. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1183-1186(Apr 1981).

Extremely smooth surfaces (less than 1 mm maximum defect size) have been produced on acrylic polymer rods by an infusion process. The technique involves bathing the rod in a mixture of a solvent and a diluent, a nonsolvent for the polymer. This causes the

rod to soften and permits limited flow and leveling of its surface. The solvent is then gradually displaced from the bath by additional diluent. As this occurs, the surface of the rod becomes rigid once more, but now with a defect-free finish. Acetone may be used as the solvent. The smoothest surfaces have been obtained using a mixture of 50% water and 50% polyethylene glycol with a molecular weight of about 4000 as the diluent.

22310 **Model acrylamide random and graft copolymers for utilization in enhanced oil recovery.** McCormick, C.L.; Neidlinger, H.H.; Hester, R.D. (Univ. of Southern Mississippi, Hattiesburg). Contract EF-77-S-05-5603. *American Chemical Society, Division of Petroleum Chemistry, Preprints ;* **26**: No. 1, 156-168(Feb 1981). (CONF-810308—(Vol.1)).

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

In recent years, an increasingly large number of commercial and experimental water-soluble polymers have become available for utilization as displacement fluids in Enhanced Oil Recovery (EOR). Unfortunately, the potential usefulness of these polymers is not easily assessed. Variations in macromolecular structure, molecular weight, branching, ionic character and hydrogen bonding capacity of each polymer type cause drastic behavioral differences under a given set of field conditions. Synthesis, characterization and rheological studies of random and graft copolymers which serve as models for use as mobility control agents in EOR have been conducted. The goals of this research project are to gain a more complete understanding of structure-property relations of water soluble macromolecules, to develop simple, yet meaningful screening tests, to project performance under field conditions and ultimately to synthesize polymers which are more efficient than those presently used in EOR. In this paper, results obtained on random copolymers of acrylamide with sodium-2-sulfoethylmethacrylate, or with sodium-2-acrylamido-2-methylpropanesulfonate, and acrylamide grafted copolymers of dextran are reported.

## 3606 Other Materials

*REFER ALSO TO CITATION(S) 21654, 21654, 21655, 21656, 21656, 21657, 21658, 21659, 21661, 21662, 21763, 21764, 21789, 21906, 22518, 22731*

22311 **(DOE/ET/23037—4) Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Final technical report, July 1, 1979-June 30, 1980.** Paul, W. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). Sep 1980. Contract AC03-79ET23037. 83p. NTIS, PC A05/MF A01.

The first objective is to determine whether field effect could be observed in samples of sputtered hydrogenated amorphous silicon, and, if it could, to compare the pseudogap density of states determined therefrom with estimates made by other methods of investigation. The second is to determine the drift mobility of excess carriers in these materials by time-of-flight, and to interpret its magnitude and temperature dependence in terms of current theories of transport in disordered semiconductors. The field effect has been observed, but the conditions required are such as to imply that deductions of the state density from it may not accurately represent the bulk density of states. In the course of this work a simpler method of reducing field effect data has been developed. The drift mobility has also been measured, but these experiments have not yet assembled sufficient statistics for final conclusions to be drawn from them.

22312 **(LA-UR—81-1443) Solid-state phase transitions in CuCl under hydrostatic pressures to 12.8 GPa.** Liebenberg, D.H.; Mills, R.L.; Huang, C.Y.; Olsen, C.; Schmidt, L.C. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 4p. (CONF-810429—30). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

The phase transitions in solid CuCl under hydrostatic conditions at pressures to 12.8 GPa are examined. The transition at 4.4 GPa from zinc-blende to tetragonal is observed. Our negative observations for the upper transition at 8.2 GPa and for the formation of an opaque phase due to the disproportionation reaction support the contention that pressure gradients are important in affecting the behavior of pure CuCl.

22313 (LBL—12548, pp 11-19) **Surface chemistry of epitaxial silicon deposition by thermal cracking of silane.** Farnaam, M. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

Modulated molecular beam experiments were conducted. Negative residence times were obtained for $SiH_4$ and Ne atoms on the surface. Planned experiments are described. 4 figures. (DLC)

22314 **Time-resolved reflectivity during pulsed-laser irradiation of GaAs.** Lowndes, D.H.; Wood, R.F. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). W-7405-ENG-26. *Applied Physics Letters ;* **38**: No. 12, 971-973(15 Jun 1981).

The first comparison of time-resolved reflectivity (TRR) signatures for crystalline and ion implantation amorphized GaAs, during pulsed ruby laser irradiation, is reported. The inferred durations of surface melting are strikingly different for the crystalline and ion-implanted cases. The measurements are in good agreement with the results of thermal melting model calculations for the crystalline case.

22315 **Self-diffusion in compressed supercritical water.** Lamb, W.J.; Hoffman, G.A.; Jonas, J. (Department of Chemistry, School of Chemical Sciences, Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801). *Journal of Chemical Physics, The ;* **74**: No. 12, 6875-6880(15 Jun 1981).

The self-diffusion coefficients D of compressed supercritical water have been measured as a function of pressure in the temperature range 400 to 700 °C using the NMR spin—echo technique. The experimental diffusion data were compared to theoretical predictions based on a dilute polar gas model using a Stockmayer potential for the evaluation of collision integrals and a temperature dependent hard sphere diameter. The empirical expression pDaT/sup n/, where n = 0.76, fits the experimental data to within +- 10% over the entire density and temperature region studied. The value of the exponent n = 0.76 agrees favorably with the n values found for diffusion of other gases. The product pD is density independent under isothermal conditions which indicates that two-body collisions dominate the diffusion behavior. This finding is in agreement with our earlier results for proton relaxation in compressed supercritical water which were analyzed using a binary collision approximation and a collision modulated spin—rotation interaction described by a single correlation function which is an exponential function of time. The hydrodynamic Stokes—Einstein equation appears to hold at densities above p/sub c/. As expected, the diffusion data cannot be described in terms of a hard sphere model but an empirical fit to lnpD = (A/T)+B, where A and B are constants, represents the experimental data well over the range of temperatures and densities studied.

22316 **Theoretical calculation of thermodynamic properties and melting curves for hydrogen and deuterium.** Young, D.A.; Ross, M. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Chemical Physics, The ;* **74**: No. 12, 6950-6955(15 Jun 1981).

Thermodynamic properties of solid $H_2$ and $D_2$ are computed from quasiharmonic lattice dynamics corrected by anharmonic terms. Liquid properties are computed from a modified hard-sphere variational perturbation theory with a quantum correction. In these models we use an intermolecular pair potential which has been fitted to high pressure solid data. The computed solid and liquid free energies are used to find the melting curves of $H_2$ and $D_2$ up to room temperature. Agreement between experiment and theory is good.

22317 **Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$.** Thomlinson, W.; Shirane, G.; Moncton, D.E.; Ishikawa, M.; Fischer, O. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter ;* **23**: No. 9, 4455-4462(1 May 1981).

$DyMo_6S_8$ and $TbMo_6S_8$ are superconducting below T/sub c/ = 2.05 K, and $ErMo_6S_8$ below T/sub c/ = 2.2 K. Neutron diffraction has been used to study the development of magnetic order in these materials at temperatures T/sub M/ less than T/sub c/. In zero applied magnetic field, the $DyMo_6S_8$ and $TbMo_6S_8$ order antiferromagnetically, the magnetic order coexisting with the superconductivity. The $ErMo_6S_8$ sample showed no long-range magnetic order when initially cooled down in zero applied magnetic field. After a magnetic field was applied and reduced to near zero, the sample showed coexistent antiferromagnetic order below T/sub M/ = 0.2 K. Magnetization measurements on $DyMo_6S_8$ and $TbMo_6S_8$ at temperatures below T/sub M/ suggest the development of ferromagnetic order as the applied field increases. In the case of $TbMo_6S_8$, the neutron data show ferromagnetic order developing for H> or =H/sub c/2 where H/sub c/2 is the upper critical field for superconductivity. For $DyMo_6S_8$ ferromagnetic order develops for H much less than H/sub c/2. Both ferromagnetic and antiferromagnetic order occur with the sample in the superconducting state.

**22318 Neutron scattering investigation of the phase transitons in uranium arsenide.** Sinha, S.K.; Lander, G.H.; Shapiro, S.M.; Vogt, O. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter ;* **23**: No. 9, 4556-4566(1 May 1981).

A number of neutron elastic scattering experiments are reported on single crystals of the compound UAs. This has the NaCl crystal structure, orders antiferromagnetically with the type-I structure (AF-I) at T/sub N/ ~ 126 K, and exhibits a first-order phase transition to the type-IA structure at 63.5 K. The most interesting behavior can be studied via the critical (diffuse) scattering near T/sub N/. Above T/sub N/ the critical scattering is anisotropic and centered about a wave vector that suggests a tendency to order with an incommensurate structure, but then at T/sub N/ suddenly orders with the commensurate type-I ordering. We present a detailed analysis by writing down a Hamiltonian in which the strong cubic anisotropy is included, and then obtain the q-dependent susceptibility via a mean-field calculation. The resulting parameters show that the z-z exchange interaction within the (001) planes is ~40 as strong as the x-x or y-y coupling between the spins. Moreover, the competition within the interactions leads to the system experiencing "frustration" in deciding between AF-I or a sinusoidal spin arrangement, so that the system is in the vicinity of a Lifshitz point. The strong cubic anisotropy is interpreted as arising from bonding effects between the 5f wave functions and the anion p orbitals.

**22319 Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn$/sub c/Cu/sub 1-c/$Cl_3$.** Endoh, Y.; Heilmann, I.U.; Birgeneau, R.J.; Shirane, G.; McGurn, A.R.; Thorpe, M.F. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter ;* **23**: No. 9, 4582-4591(1 May 1981).

In a recent paper we reported a neutron scattering study of the random one-dimensional (1D) Heisenberg antiferromagnetic $(CD_3)_4NMn$/sub c/Cu/sub 1-x/$Cl_3$, with c = 0.93 and 0.85. The main emphasis was on the static properties. In the present publication we present the results and analyses of extended quasielastic and inelastic neutron scattering experiments at temperatures down to 0.3 K. The low-temperature behavior of the inverse correlation length k and staggered susceptibility x(Q = r) of the c = 0.93 specimen indicates that the exchange J/sub CuhyphenCu/ between pairs of $Cu^{++}$ ions is ferromagnetic. Well-defined spin-wave-like excitations are observed for wave vectors larger than a critical wave vector q/sub cr/. The low-temperature measurements indicate that q/sub cr/ is governed by the percolation limit k/sub c/ of k itself, indicating that the observed excitations are associated with the pure $Mn^{++}$ segments. We have carried out spin-wave perturbation calculations and computer simulations of the spin-dynamical properties of the dilute classical Heisenberg chain at T = 0. These two calculations are in good agreement with each other. No Ising resonances, associated with states at chain ends, were found in these calculations. These resonances occur in similar systems in higher dimensions but are shown not to occur in 1D because of the singular nature of the density of states at the band edges. For q>q/sub cr/, the observed inelastic scattering response is quantitatively accounted for by means of the perturbation calculations. For q ~ q/sub cr/ the experimentally measured line shapes are in qualitative agreement with the computer simulations.

**22320 Infrared refractive index of diamond.** Edwards, D.F.; Ochoa, E. (Los Alamos National Laboratory, University of California, P. O. Box 1663, Los Alamos, New Mexico 86545). *Journal of the Optical Society of America ;* **71**: No. 5, 607-608(May 1981).

The refractive index of natural Type IIa diamond is reported for spectral region 2.5—25mm. The data have been filtered to a Herzberger-type dispersion formula with a quality of fit of a few places in the fifth decimal place. The resultant index uncertainty is abut $10^{-3}$.

**22321 Detection of a $ScD_2$ film decomposition by AES.** Malinowski, M.E. (Sandia National Laboratories, Livermore, California 94550). *Journal of Vacuum Science and Technology, The ;* **19**: No. 1, 120-122(May 1981).

It is shown that there is a linear relation between the amount of $ScD_2$ decomposition as the result of step heating and the Auger peak-to-peak height. (AIP)

**22322 Analysis of transition metal carbonyl Auger line shapes.** Jennison, D.R.; Stucky, G.D.; Rye, R.R.; Kelber, J.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-76-DP00789. *Physical Review Letters ;* **46**: No. 14, 911-914(6 Apr 1981).

The carbon Auger line shapes obtained from three diverse gas-phase transition-metal carbonyls are analyzed. Some features in the line shape directly reflect the amount of r backbonding. The analysis indicates that the dominant initial state is the adiabatically relaxed ground state. The final-state holes are either localized on the same ligand or described by a state consisting of one hole on a ligand and the other on the metal atom. The latter state may be viewed as a r-backbonding-assisted interatomic decay.

**22323 Oxidation of Si(111), 7 x 7 and 2 x 1: A comparison.** Su, C.Y.; Skeath, P.R.; Lindau, I.; Spicer, W.E. (Department of Electrical Engineering, Stanford University, Stanford, California 94305). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 843-846(Apr 1981).

The initial processes of oxygen adsorption on the 2 x 1 and 7 x 7 Si(111) surfaces are studied in detail with photoemission techniques. The high-energy resolution and high surface sensitivity Si-2p core level spectra have revealed clearly the different nature of the oxygen adsorption processes on the two surfaces. Analysis of the oxidation properties of the 7 x 7 surface gives strong support for "defect"-type models of the 7 x 7 structure.

**22324 Atomic structure of laser annealed Si(111)—(1 x 1).** Zehner, D.M.; Noonan, J.R.; Davis, H.L.; White, C.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). W-7405-ENG-26. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 852-855(Apr 1981).

Although the stable surface structure of a clean, thermally annealed Si(111) is a (7 x 7) at room temperature, a metastable (1 x 1) structure can be obtained by irradiating the crystal with the output of a pulsed ruby laser. The structural determination of this atomically clean (1 x 1) arrangement is important since it may subsequently be used as a basis for the eventual understanding of the (7 x 7) reconstruction. A LEED analysis of the (1 x 1) structure is reported in which I—V profile data for the six lowest indexed nonspecular beams have been collected with the incident electron beam normal to the surface. These experimental profiles have been compared with the results of dynamical calculations, in which the first and second interlayer spacings of the truncated bulk model were varied. Also, nonstructural parameters have been varied in the calculations. The results suggest a bulklike layer termination exhibiting no ordered lateral reconstruction with the first interlayer spacing contracted by 25.5 +- 2.5% and the second expanded by 3.2 +- 1.5% with respect to bulk values. The best comparison between calculated and experimental I—V profiles has produced a six-beam Zanazzi and Jona R-factor of 0.115.

22325 **Atom probe analysis of rf-sputtered a-Si:H films.** Krishnaswamy, S.V.; Messier, R.; Wu, C.S.; McLane, S.B.; Tsong, T.T. (Materials Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania 16802). DE-AC03-79ET23038;XG-O-9227. *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 309-312(Mar 1981).

Using a computerized energy compensated time of flight atom probe (APFIM), we have obtained the average composition (Si,H,O) of two widely differing hydrogenated amorphous silicon rf-sputtered films which were deposited onto W field emitter tips. Analysis of the evaporated ion species shows that the films prepared at the lower total gas pressure (5 mTorr) contain predominantly SiH and Si units while at the higher pressure (20 mTorr) the additional units of $SiH_2$ and $SiH_3$ are also present. These results are compared to films prepared and characterized on planar substrates and found to be in agreement.

# 40 CHEMISTRY

## 4001 Analytical And Separations Chemistry

*REFER ALSO TO CITATION(S) 21501, 21501, 21593, 21613, 21613, 21624, 21637, 21637, 21638, 21638, 21646, 21647, 21689, 21693, 21695, 21696, 21697, 21700, 21702, 21703, 21706, 21707, 21708, 21709, 21711, 21712, 21716, 21718, 22412, 22516, 22517, 22582, 22589*

22326 **(DOE/ER/05016—3) Separation of alkali, alkaline earth and rare earth cations by liquid membranes containing macrocyclic carriers. Third progress report, September 1, 1980-April 1, 1981.** Christensen, J.J. (Brigham Young Univ., Provo, UT (USA). Thermochemical Inst.). 15 Apr 1981. Contract AS02-78ER05016. 29p. NTIS, PC A03/MF A01.

The overall objective of this project is to study the use of liquid membrane systems employing macrocyclic ligand carriers in making separations among metal cations. During the third year of the project, work continued in the development of a mathematical model to describe cation transport. The model was originally developed to describe the relationship between cation transport rate (J/ sub M/) and the cation-macrocycle stability constant (K). The model was tested by determining the rates of transport of alkali and alkaline earth cations through chloroform membranes containing carrier ligands where the stability constants for their reaction with cations in methanol were known. From the results, it is clear that the model correctly describes the dependence of J/sub M/ on log K. The model also correctly describes the effect of cation concentration and carrier concentration on cation transport rates, as detailed in the previous progress report. During the third year of the project, the transport model was expanded so as to apply to competitive transport of cations from mixtures of two cations in the source aqueous phase. Data were collected under these conditions and the ability of the model to predict the flux of each cation was tested. Representative data of this type are presented along with corresponding data which were obtained when each cation was transported by the same carrier from a source phase containing only that cation. Comparison of transport rates determined under the two experimental conditions indicates that the relationship between the two sets of data is complex. To date, a few of these data involving transport from binary cation mixtures have been tested against the transport model. It was found that the model correctly predicts the cation fluxes from cation mixtures. These preliminary results indicate that the transport model can successfully predict separation factors when cation mixtures are used.

22327 **(GEPP-TIS—569) Comparison of semiautomatic and fully automatic water titrators.** Middleton, H.W. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 22 May 1981. Contract AC04-76DP00656. 17p. NTIS, PC A02/MF A01.

Semiautomatic titration of water using the Karl Fischer single solution conductometric method takes an average of 5 to 15 minutes per test. A new, fully automatic titrator is available that can complete titration at an average rate of three to ten minutes per test. The automatic method of titration is internally standardized (electrically) at all times, eliminating the two hour (average) standardization period required by the semiautomatic method. A digital readout register displays results in micrograms of water, disposing of manual calculations for one gram samples. Identical samples were tested by both the semiautomatic and the automatic methods, resulting in equally accurate calculations of water content.

22328 **(LA-UR—81-1511) Multi-energy gamma-ray automated scanning system.** Hsu, H.H.; Pratt, J.C.; Shunk, E.R. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 14p. (CONF-810647—2). NTIS, PC A02/ MF A01.

From Conference on X-and gamma-ray sources and applications; Ann Arbor, MI, USA (10 Jun 1981).

A CAMAC-based gamma-ray scanning system was used to measure the transmission through stacked attenuators for up to 16 different gamma rays. For each measurement, we obtained the transmission for gamma rays ranging in energy from 77 to 2614 keV. These transmission measurements were used to produce a set of linear equations that may be solved for either thickness or density of the discrete attenuators comprising a given stacked assembly.

22329 **(LA-UR—81-1526) Laser-induced breakdown spectroscopy: detecting sodium and potassium in coal gasifiers.** Loree, T.R.; Radziemski, L.J. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 30p. (CONF-810607—2). NTIS, PC A03/MF A01.

From Symposium on instrumentation and control for fossil energy processes; San Francisco, CA, USA (8 Jun 1981).

The goal of this research program is the eventual development of a real-time monitor of trace quantities of elements present in hostile environments such as coal gasifier process streams. With laser-induced breakdown spectroscopy (LIBS), we have demonstrated the ability to probe a real process stream and achieve appropriate levels of detectability for sodium and potassium with real-time response. TRELIBS (time-resolved LIBS) will extend the capabilities of this form of emission spectroscopy to both better sensitivity and higher pressure environments. The difficult problem of quantification is being investigated.

22330 **(LA-UR—1461) Determination of plutonium isotopic composition by gamma-ray spectroscopy.** Sampson, T.E.; Hsue, S.T.; Parker, J.L.; Johnson, S.S.; Bowersox, D.F. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 19p. (CONF-810647—4). NTIS, PC A02/ MF A01.

From Conference on X-and gamma-ray sources and applications; Ann Arbor, MI, USA (10 Jun 1981).

We discuss the general approach, computerized data analysis methods, and results of measurements used to determine the isotopic composition of plutonium by gamma-ray spectroscopy. The simple techniques are designed to be applicable to samples of arbitrary size, geometry, age, chemical, and isotopic composition. The combination of the gamma spectroscopic measurement of isotopic composition coupled with calorimetric measurement of total sample power is shown to give a totally nondestructive determination of sample plutonium mass with a precision of 0.6% for 1000-g samples of $PuO_2$ with 12% $^{240}Pu$ content. The precision of isotopic measurements depends upon many factors, including sample size, sample geometry, and isotopic content. Typical ranges are found to be $^{238}Pu$, 1 to 10%; $^{239}Pu$, 0.1 to 0.5%; $^{240}Pu$, 2 to 5%; $^{241}Pu$, 0.3 to 0.7%; $^{242}Pu$ (determined by isotopic correlation); and $^{241}Am$, 0.2 to 10%.

22331 **Development of some natural matrix standards - progress report.** Volchok, H.L.; Feiner, M. (Department of Energy, New York (USA). Environmental Measurements Lab.); Inn, K.G.W. (Department of Commerce, Gaithersburg, MD (USA). Bureau of Standards); McInroy, J.F. (Los Alamos Scientific Lab., NM (USA)). *Environment International ;* **3**: No. 5, 395-398(1980).

From Traceability and quality control in the measurement of environmental activity; Brunswick, Germany, F.R. (18 - 19 Jun 1979).

Substantial progress has been made in the production of environmental level, natural matrix, radioactivity standards of soil of low organic and low carbonate content, and of human lung and human liver. This is in response to the deliberations of the 1977

ICRM meeting at which the need for such standards was voiced and the criteria suggested. The soil samples have been reduced to optimum particle size and are ready for blending and standardization. A ten year supply of this standard should be ready in a year or less. Reducing the dried lung and liver to less than 74 μm has proven formidable because of the natural fat and oil content. Using cryogenic milling techniques more than three quarters of the total mass of each has been reduced to the desired particle size; the balance will either be reduced or removed and we can then proceed to the final standardization.

22332 **(ORNL—5738) Analytical Chemistry Division. Annual progress report for period ending December 31, 1980.** Lyon, W.S. (ed.). (Oak Ridge National Lab., TN (USA)). May 1981. Contract W-7405-ENG-26. 172p. NTIS, PC A08/MF A01.

This report is divided into: analytical methodology; mass and emission spectrometry; technical support; bio/organic analysis; nuclear and radiochemical analysis; quality assurance, safety, and tabulation of analyses; supplementary activities; and presentation of research results. Separate abstracts were prepared for the technical support, bio/organic analysis, and nuclear and radiochemical analysis. (DLC)

22333 (ORNL—5738, pp 41-53) **Technical support.** Corbin, L.T. May 1981. NTIS, PC A08/MF A01.

In Analytical Chemistry Division. Annual progress report for period ending December 31, 1980.

Activities are reported: the radioactive materials analytical lab, the general analytical lab, the transuranium analysis lab, the reactor programs (consolidated fuel reprocessing, SYNROC as alternative radioactive waste form, graphite oxidation), and special projects. Data are given for the dehydration of UNH and other uranyl nitrates, and the reaction of sugar with nitric acid. (DLC)

22334 (ORNL—5738, pp 55-80) **Bio/organic analysis section.** Guerin, M.R. May 1981. NTIS, PC A08/MF A01.

In Analytical Chemistry Division. Annual progress report for period ending December 31, 1980.

Topics studied in this section include: analysis of natural and synthetic fossil fuels, cigarette smoke, organics in respirable particles, isolation of PAHs in aqueous samples, characterization of amines, neutral aromatic polar fractions in synfuels, a cricket teratogen, $^{13}C$ NMR shifts in condensed aromatics, inhalation, hazardous wastes, and production of oil aerosols.

22335 (ORNL—5738, pp 81-95) **Nuclear and radiochemical analysis.** Stokely, J.R. May 1981. NTIS, PC A08/MF A01.

In Analytical Chemistry Division. Annual progress report for period ending December 31, 1980.

Activities are reported for three groups: radiochemical and activation analysis, low-level radiochemical analysis, and special projects ((radionuclides in animals and insects, γ-ray spectroscopy, ion exchange of radionuclides from river water, etc.). (DLC)

22336 **(RHO-SA—218) Determination of EDTA and HEDTA in Hanford defense waste by high-performance liquid chromatography.** Metcalf, S.G. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). Feb 1981. Contract AC06-77RL01030. 36p. (CONF-810308—12). NTIS, PC A03/MF A01.

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

A High Performance Liquid Chromatographic (HPLC) method to determine ethylenediaminetetraacetic acid (EDTA) and N-hydroxyethyl-ethylenediaminetriacetic acid (HEDTA) has been developed. The method suffers no significant analytical interferences and has a detection limit of $10^{-2}$M for both EDTA and HEDTA in Hanford Defense Waste (HDW). Actual samples of HDW have been successfully analyzed. The average spike recovery for EDTA and HEDTA was 99% and 100% with relative standard deviations of 4.8% and 2.6%, respectively. Non-routine analytical support is available from the Process Development Group and Research and Engineering. Transfer of this technology to Analytical Laboratories and Quality Assurance (QA) has been initiated.

22337 **(SAND—81-0331C) Digitally controlled x-ray mapping.** Chambers, W.F. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810705—2). NTIS, PC A02/MF A01.

From 16. annual conference of the Microbeam Analysis Society; Vail, CO, USA (13 Jul 1981).

For making x-ray maps in electron microprobe analysis, a system is described which calculates and sets instrumental parameters so that trial-and-error is eliminated and a properly exposed x-ray map is generated every time. The procedure is given for Fe. The system has been used to prepare x-ray maps of oxides in a simulated nuclear waste sample; an example is given. (DLC)

22338 **Simple interpretation of Raman excitation spectra of metalloporphyrins.** Shelnutt, J.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Chemical Physics, The ;* **74**: No. 12, 6644-6657(15 Jun 1981).

A simple treatment of vibronic coupling in metalloporphyrins is described. Electronic degeneracy in the excited states is treated to arrive at simple expressions for the Raman excitation spectra and the absorption spectrum. The expressions are simple analogs of the usual A and B term expressions for the scattering tensor and are easily programmed for a small computer. They are only applicable in the weak vibronic coupling limit, but are nevertheless suitable for interpretation of the spectra of most biologically relevant porphyrin systems, at least as a starting point. They allow a simple discussion of a number of interference phenomena that influence the Raman intensity distribution in the excitation profiles of metalloporphyrins and other molecular systems. Some of these phenomena are consequences of electronic degeneracy in the resonant excited state. Nonadiabatic coupling contributions are also included in the expressions. Experimental Raman excitation spectra are discussed in light of this simple model.

22339 **Collisional redistribution of vibrational energy in $CO_2$-laser-excited benzene.** Lyman, J.L.; Feldmann, D.; Laukemper, J.; Welge, K.H. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics, The ;* **74**: No. 12, 6817-6823(15 Jun 1981).

We have monitored changes in the population of benzene vibrational levels during and after irradiation with an intense $CO_2$-laser pulse. Our method was to induce fluorescence from the first excited singlet state ($^1$B/sub 2u/) by absorption of tunable ultraviolet radiation. By varying the delay time between the infrared and ultraviolet pulses and by employing ultraviolet frequencies within many bands of the $^1$A/sub 1g/—$^1$B/sub 2u/ system, we measured the temporal evolution of the vibrational energy distribution over 12 benzene levels. We also used the technique to assign bands of the ultraviolet absorption spectrum that involve vibrational levels pumped by the infrared laser.

22340 **Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry.** Perry, D.L. (Univ. of California, Berkeley); Klainer, S.M.; Bowman, H.R.; Milanovich, F.P.; Hirschfeld, T.; Miller, S. Contract W-7405-ENG-48. *Analytical Chemistry ;* **53**: No. 7, 1048-1050(Jun 1981).

A new method of analysis for ultratrace quantities of ururanium in aqueous samples has been developed with a detection limit of 4 x $10^{-14}$M($10^{-5}$ ppb, 0.01 pg/mL). This detection level is considerably less than the average concentration of 0.1 ppb uranium found in natural groundwaters. The procedure consists of an initial coprecipitation of the solution uranium with calcium fluoride, calcination at 800°C, and monitoring the uranium content by laser-induced fluorescence excitation (LIFE). Analytical data using this technique are presented for previously analyzed groundwater samples containing $10^{-6}$-$10^{-7}$M uranium. The fluorescence yield dependence on calcination time and temperature and on cation and anion interferences is discussed.

22341 **Ribbon storage techniques for liquid chromatography: mass spectrometry.** Smith, R.D.; Johnson, A.L. (Pacific Northwest Lab., Richland, WA). Contract DE-AC06-761830. *Analytical Chemistry ;* **53**: No. 7, 1120-1122(Jun 1981).

A new liquid chromatography-mass spectrometry (LC-MS) has been developed which allows semipermanent storage of the chromatographically separated material on a moving ribbon permitting multiple temperature analyses of a single LC separation. The new interface removes the major disadvantage of conventional moving ribbon devices by allowing analysis of a single LC separation at several different temperatures. Reconstructed ion chromatograms for the molecular ions in a standard mixture of benzopyrene, chrysene, carbazole, 7 amino-4-hydroxyquinoline, 5-hydroxyquinoline, 5-aminoquinoline, 5-hydroxy indole, and o-cresol are presented. The results are for a single injection and two passes of the separated material through desorption region at 195°C and 285°C. Reconstructed ion chromatograms are also presented for eight typical ions in an analysis of a biomass product for a single injection at three different ribbon passes through the flash heater.

22342 **Detection of iodine-129 by laser-induced fluorescence spectrometry.** Goles, R.W.; Fukuda, R.C.; Cole, M.W.; Brauer, F.P. (Pacific Northwest Lab., Richland, WA). Contract AC06-76RLO-1830. *Analytical Chemistry ;* **53**: No. 6, 776-778(May 1981).

Isotopically specific fluorescence detection of elemental iodine-129 has been investigated with a broad-band dye laser system. The intracavity spoiling phenomenon was utilized in this investigation to achieve isotopic specificity and to effect a modulated fluorescence signal. This rugged laser-based analytical system was found to exhibit a conventional linear relationship between signal level and analyte concentration, although laser-based instabilities limited detection limits of this approach to concentrations greater than $10^{10}$ molecules/cm$^3$. Fluorescence measurements were also accomplished by direct single frequency excitation of $^{129}I_2$. This method of excitation exhibited a fluorescence detection limit of 2 x $10^9$ molecules/cm$^3$ and proved to be more sensitive than the broad-band approach.

22343 **Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry.** Petersen, J.C.; Plancher, H. (Laramie Energy Technology Center, WY). *Analytical Chemistry ;* **53**: No. 6, 786-789(May 1981).

A method for determining the concentration of carboxylic acids and anhydrides in asphalts and asphalt fractions has been developed. In addition, carboxylate salts are determined independently from the free acids. The method is based on the selective interaction of triphenyltin hydroxide with free carboxylic acids, the hydrolysis of acids and anhydrides with sodium hydroxide, and the silylation of free acids and their salts. Differential spectra are used to make the quantitative determinations.

22344 **Mixed ligand chelate extraction of lanthanides with 5,7-dibromo-8-quinolinol systems.** Tochiyama, O.; Freiser, H. (Univ. of Arizona, Tucson). *Analytical Chemistry ;* **53**: No. 6, 874-877(May 1981).

The equilibrium extraction behavior is studied for a series of representative tervalent lanthanide ions, Pr, Eu, and Yb, using chloroform solutions containing either 5,7-dibromo-8-quinolinol (HQ) alone or combined with 1,10-phenanthroline (phen) or tetra-n-heptylammonium chloride ($R_4NCl$). The results demonstrate that these lanthanides are extracted as $LnQ_3.HQ$ or in the presence of phen as $LnQ_3.phen$ or in the presence of $R_4NCl$ as $R_4NLnQ_4$. Although 8-quinolinol forms more stable chelates with these metals, the higher acid dissociation constant of the dibromo compound results in increased extraction constants, making extraction possible in lower pH ranges. Furthermore, the effect of phen or $R_4NCl$ on the extraction and separation of lanthanides by 5,7-dibromo-8-quinolinol is more pronounced than their effect in the 8-quinolinol system.

22345 **Laser-excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons.** Yang, Y.; D'Silva, A.P.; Fassel, V.A. (Iowa State Univ., Ames). Contract W-7405-ENG-82. *Analytical Chemistry ;* **53**: No. 6, 894-899(May 1981).

The sharp-line absorption spectra (full width at half-maximum of 1 to 10 cm$^{-1}$) exhibited by polynuclear aromatic hydrocarbons (PAHs) in frozen Shpol'skii hosts facilitate selective excitation of the luminescence spectra through tunable dye laser excitation. In this communication we present observations that document the general utility of laser-excited Shopol'skii spectroscopy (LESS) for the direct qualitative and quantitative characterization of complex mixtures of PAHs, including multialkylated isomers.

22346 **Cancellations in atomic dipole transition moments in the Cu isoelectronic sequence.** Curtis, L.J. (Department of Physics and Astronomy, University of Toledo, Toledo, Ohio 43606). DE-AS05-80ER1076. *Journal of the Optical Society of America ;* **71**: No. 5, 566-568(May 1981).

A number of cancellation anomalies in lifetimes and emitted intensities in the Cu isoelectronic sequence are predicted, and their use as an experimental probe of small perturbations is discussed.

22347 **Spectrum and energy levels of nine-times ionized strontium [Sr X].** Acquista, N.; Reader, J. (National Bureau of Standards, Washington, D. C. 20234). *Journal of the Optical Society of America ;* **71**: No. 5, 569-573(May 1981).

The spectrum of the copperlike ion Sr X was observed with a low-inductance spark in the region 70—630 A on the 10.7—m grazing-incidence spectrograph at the National Bureau of Standards. From the identification of 30 lines, a system of 23 energy levels of the type $3d^{10}nl$ was determined. The level system includes the configurations ns (n = 4—7), np (n = 4—6), nd (n = 4—6), nf (n = 4—6), and ng (n = 5). The $4f^2F$ term is inverted. Also identified were 12 transitions of the type $3d^{10}4s$—$3d^94s4p$ and $3d^{10}4p$—$3d^94p^2$, permitting the determination of several $3d^94s4p$ and $3d^94p^2$ levels. The observed $3d^{10}nl$ energy levels and parameters are compared with Hartree—Fock calculations. The ionization energy is determined from the $3d^{10}ns$ and nf series to be 1 430 000 +- 500 cm$^{-1}$ (177.30 +- 0.06 eV). Data for 3d—4p transitions in Sr IX and Sr XI and 3p—3d transitions in Sr XII are also presented.

22348 **Chemical information from Auger electron spectroscopy.** Madden, H.H. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-76-DP 00789. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 677-689(Apr 1981).

The nature of chemical information in Auger electron spectroscopy (AES) data is reviewed with special emphasis on data from solid surface systems. Two strategies are most frequently used to extract this information: (i) measuring and analyzing energy (chemical) shifts in Auger peaks; and (ii) making use of the shapes of Auger signals to determine the chemical environment at the site of the initial core hole. Chemical shift data are primarily illustrated by highlighting the interaction of oxygen with solids; and analyses of these data based on core-level binding-energy shifts, relaxation, and hole—hole interactions are outlined and discussed. Auger transitions that involve valence electrons are usually those for which lineshapes are taken as indications of the local chemistry at the initial core-hole site. Attempts at extracting valence band density-of-states information from lineshapes are proving successful and this approach to the surface chemical information in AES is illustrated with the aid of examples dealing with the interaction of silicon with hydrogen and with oxygen. The use of the AES lineshapes simply as "fingerprints" of the core-hole-site chemistry is examined and illustrated by examples which include studies of silicon nitride properties, of solid surface properties related to catalytic reactions, and of passive films on iron. Auger decay activated desorption processes are briefly examined and found to promise new and unique chemical information when combined with conventional AES. Some gas phase AES studies are also briefly reviewed.

22349 **Thermodynamics of extraction of U(VI) and Th(IV) from nitric acid by neutral phosphorus-based organic compounds.** Kalina, D.G.; Mason, G.W.; Horwitz, E.P. (Argonne National Lab., IL (USA)). *Journal of Inorganic and Nuclear Chemistry ;* **43**: No. 1, 159-163(1981).

The extraction of Th(IV) and U(VI) from dilute nitric acid solution by several neutral phosphorus-based extractants has been studied as a function of temperature in the range of 0 to 50°C. From the variation of the distribution ratio (Ksub(d)) with temperature the thermodynamic quantities $\Delta G$, $\Delta H$ and $\Delta S$ have been calculated for these extractions. The results of this study indicate that the steric bulk of the extractant plays a major role in determining how well Th(IV) is extracted. The size of the extractant appears to

be of little or no importance in the extraction of U(VI). Similarly, the basicity of the extractant is of lesser importance in the extraction of uranyl ion relative to thorium ion.

22350 **In-plant evaluation of a uranium NDA system.** Sprinkle, J.K. Jr.; Baxman, H.R.; Langner, D.G.; Canada, T.R.; Sampson, T.E. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 324-341(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

A uranium solution assay system (USAS) has been installed to allow accurate and more timely process control, accountability, and criticality data to be obtained. The USAS assays are made by a variety of techniques that depend upon state-of-the-art high-resolution Ge(Li) gamma-ray spectroscopy integrated with an interactive, user-oriented computer software package. A comparison of the USAS precision and accuracy with that obtained by traditional destructive analytical chemistry techniques (colorimetric and volumetric) is presented. 5 refs.

22351 **Experimental u-233 nondestructive assay with a random driver.** Goris, P. (Hanford Eng Dev Lab, Richland, Wash). *National Bureau of Standards (U.S.), Special Publication ;* 602-616(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Nondestructive assay (NDA) of U-233 in quantities up to 15 grams containing 7 ppm U-232 age 2 years was investigated with a random driver. A passive singles counting technique showed a reproducibility within 0.2% at the 95% confidence level. This technique would be applicable throughout a process in which all of the U-233 had the same U-232 content at the same age. 8 refs.

22352 **Low level uranium determination by constant current coulometry.** Mitchell, W.G.; Lewis, K. (US DOE, Argonne, Ill). *National Bureau of Standards (U.S.), Special Publication ;* 140-146(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

A titrimetric method for the determination of uranium, originally developed by Davies and Gray, was evaluated by the New Brunswick Laboratory (NBL) and found to be relatively selective and simple. Extensive investigation of the procedure at NBL led to modifications resulting in precise and accurate titration for uranium which was relatively rapid and specific. 13 refs.

22353 **Computer-assisted controlled-potential coulometric determination of plutonium for safeguards measurements.** Holland, M.K.; Frazzini, T.L.; Weiss, J.R.; Pietri, C.E. (US DOE, Argonne, Ill). *National Bureau of Standards (U.S.), Special Publication ;* 164-168(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

A computer-assisted coulometric system, based on the New Brunswick Laboratory (NBL) manual controlled-potential coulometric method for plutonium determination has been developed. This system reduces the costs and operating time for plutonium measurements without loss in reliability in the analysis nuclear safeguards materials. 10 refs.

22354 **Demonstration of totally sampled wavelength dispersive XRF for use in the assay of the SNM content of dissolver solutions.** Hudgens, C.R.; Craft, B.D. (Monsanto Res Corp, Miamisburg, Ohio). *National Bureau of Standards (U.S.), Special Publication ;* 547-554(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

X-Ray fluorescence analysis of simulated special nuclear materials in solution was demonstrated, using totally sampled, continuously recirculated solutions, some of which contained slurried analyst and dense matrix. The total sampling system contributed no identifiable variation to the data, and the slurried matter, at particle sizes of 20 micrometers or less, contributed no systematic error. 2 refs.

22355 **Gamma-ray measurements for uranium enrichment standards.** Rielly, T.D. (Los Alamos Sci Lab, NM). *National Bureau of Standards (U.S.), Special Publication ;* 103-110(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The gamma-ray spectroscopic measurement of uranium enrichment is one of the most widely used nondestructive analysis techniques. A study has been started of the precision and accuracy achievable with this technique and the physical parameters which affect it. Results reported using a high-quality Ge(Li) spectrometer system show reproducibility comparable to that attainable with mass spectrometry. 6 refs.

22356 **Acid-compensated multiwavelength determination of uranium in process streams.** Bostick, D.T. (Oak Ridge Natl Lab, Tenn). *National Bureau of Standards (U.S.), Special Publication ;* 121-128(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Uranyl absorbance was measured in the presence of 0.02-5M HNO/sub 3/ to determine the effect of nitric acid concentration on the absorbance of uranium in the concentration range of 20-200 g/l. The uranyl absorance was found to be primarily the result of three uranyl species. 10 refs.

22357 **Application of a direct method for the determination of trace uranium in safeguards samples by pulsed laser fluorometry.** Zook, A.C.; Collins, L.H. (US DOE, Argonne, Ill). *National Bureau of Standards (U.S.), Special Publication ;* 147-155(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

A direct method for the fluorometric determination of trace amounts of uranium in solution has been developed. Precision and accuracy are better than 5% with a sensitivity of 0.005 ng U. The method employs a pulsed nitrogen laser to excite uranium atoms in solution containing a pyrophosphate fluorescence reagent. The resulting fluorescence is filtered, electronically gated, and integrated. A standard addition technique is used to overcome sample matrix effects. 4 refs.

22358 **Analysis of plutonium and uranium by the resin bead-mass spectrometric method.** Walker, R.L.; Smith, D.H. (Oak Ridge Natl Lab, Tenn). *National Bureau of Standards (U.S.), Special Publication ;* 538-546(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

The development of the resin bead method and the techniques employed in its application to isotopic analysis of Pu and U in highly radioactive solutions of spent reactor fuel will be decribed. The method, developed primarily for safeguards analyses, may also be applied to isotopic measurements for assessing nuclear fuel cycle technology. 8 refs.

22359 **Automated ion-exchange system for the rapid separation of plutonium from impurities in safeguards analyses.** Freeman, B.P.; Weiss, J.R.; Pietri, C.E. (US DOE, Argonne, Ill). *National Bureau of Standards (U.S.), Special Publication ;* 156-163(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Many plutonium samples cannot be analyzed directly after dissolution because of their high impurity content. The demand to increase sample analysis output, to decrease sample turnaround time, and to reduce operating costs, has prompted the development of an automated system, AUTOSEP, based on the manual ion-exchange method. The AUTOSEP system is designed as a batch-type operation in which ten sample aliquots are simultaneously passed through mini ion-exchange columns. 9 refs.

22360 **Membrane separation of a $CO_2$-$N_2$ mixture using steam.** Gel'perin, N.I.; Pebalk, W.L.; Zamyshlyaev, V.G.; Taran, A.L.; Andreev, B.D.; Serebryakov, V.N. *Soviet Chemical Industry (English Translation) ;* **12**: No. 5, 575-579(May 1980).

A study was made of the gas permeability and selectivity of membranes (100 $cm^2$ surface area), made of Lavsan [Soviet equivalent of dacron] (20 $\mu$ thick) and SKTV-2T rubber (900 $\mu$ thick) which are used for separation of a gaseous mixture of $CO_2$ and $N_2$. Results show that the gas permeability and selectivity of the investigated membranes are practically independent of the composition of the binary gaseous mixture.

**22361 Continuous chromatographic reactor.** Cho, B.K.; Carr, R.W. Jr.; Aris, R. (Univ. of Minnesota, Minneapolis). Contract EY-76-02-2945. *Chemical Engineering Science ;* **35**: 74-81(1980).

Reaction chromatography has been done on a continuous basis in a reactor configuration consisting of a packed cylindrical annulus with a rotating feed port. Chromatographic action causes spatial separation of product streams emerging from the annular exit. This has been demonstrated by an experimental study of the acid catalyzed hydrolysis of aqueous methyl formate. Furthermore, separation of the products, formic acid and methanol, suppresses the reverse reaction causing conversions to be significantly greater than equilibrium conversions. A mathematical model of the reactor has been developed and used for numerical simulation of reactor behavior. Dispersion characteristics of the bed, adsorption isotherms and reaction kinetics were all determined in independent experiments, and used as input data for the model. Comparisons of numerically simulated reactor performance with experimental results showed good agreement.

**22362 Biodegradation tests: use and value.** Gilbert, P.A.; Lee, C.M. (Unilever Research Lab., Port Sunlight, England). pp 34-45 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

A large number of laboratory biodegradability tests are currently used for the assessment of biodegradation potential of chemicals. To compare these existing methods, this paper attempts to clarify the methods on the basis of the information which they provide. Tests are recognized in two major categories: biodegradation potential tests and simulation tests. Tests of ready biodegradability provide convincing evidence that the material will rapidly and completely break down under environmental conditions, and tests of inherent biodegradability provide more favorable conditions for the degradation of the compound and can yield evidence of the rate of biodegradation. Under the category of simulation tests, there exist a great variety of tests designed to provide information on the rate of biodegradation under environmentally relevant conditions.

## 4002 Inorganic And Physical Chemistry

*REFER ALSO TO CITATION(S) 21581, 21731, 22275, 22295, 22326, 22384, 22384, 22388, 22389, 22393, 22393, 22406, 22779, 22780, 22782*

**22363 (DOE/ER/04447—124) Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements.** Hobart, D.E. (Tennessee Univ., Knoxville (USA)). Jun 1981. Contract AS05-76ER04447. 168p. NTIS, PC A08/MF A01.

Thesis.

Simultaneous observation of electrochemical and spectroscopic properties (spectroelectrochemistry) at optically transparent electrodes (OTE's) was used to study some less stable oxidation states of selected lanthanide and actinide elements. Cyclic voltammetry at microelectrodes was used in conjunction with spectroelectrochemistry for the study of redox couples. Additional analytical techniques were used. The formal reduction potential ($E^{0\prime}$) values of the M(III)/M(II) redox couples in 1 M KCl at pH 6 were -0.34 +- 0.01 V for Eu, -1.18 +- 0.01 V for Yb, and -1.50 +- 0.01 V for Sm. Spectropotentiostatic determination of $E^{0\prime}$ for the Eu(III)/Eu(II) redox couple yielded a value of -0.391 +- 0.005 V. Spectropotentiostatic measurement of the Ce(IV)/Ce(III) redox couple in concentrated carbonate solution gave $E^{0\prime}$ equal to 0.051 +- 0.005 V, which is about 1.7 V less positive than the $E^{0\prime}$ value in noncomplexing solution. This same difference in potential was observed for the $E^{0\prime}$ values of the Pr(IV)/Pr(III) and Tb(IV)/Tb(III) redox couples in carbonate solution, and thus Pr(IV) and Tb(IV) were stabilized in this medium. The U(VI)/U(V)/U(IV) and U(IV)/U(III) redox couples were studied in 1 M KCl at OTE's. Spectropotentiostatic measurement of the Np(VI)/Np(V) redox couple in 1 M $HClO_4$ gave an $E^{0\prime}$ value of 1.140 +- 0.005 V. An $E^{0\prime}$ value of 0.46 +- 0.01 V for the Np(VII)/Np(VI) couple was found by voltammetry. Oxidation of Am(III) was studied in concentrated carbonate solution, and a reversible cyclic voltammogram for the Am(IV)/Am(III) couple yielded $E^{0\prime}$ = 0.92 +- 0.01 V in this medium; this value was used to estimate the standard reduction potential ($E^0$) of the couple as 2.62 +- 0.01 V. Attempts to oxidize Cm(III) in concentrated carbonate solution were not successful which suggests that the predicted $E^0$ value for the Cm(IV)/Cm(III) redox couple may be in error.

**22364 (LBL—12127) Combustion diagnostics by tunable atomic line molecular spectroscopy.** Cuellar, E.; Brown, N.J. (Lawrence Berkeley Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 7p. (CONF-810704—3). NTIS, PC A02/MF A01.

From 1. international specialists meeting of the Combustion Institute; Bordequx, France (20 Jul 1981).

TALMS was used to detect and measure $S_2$ formed in the equilibrium vapor of elemental sulfur, and from the thermal decomposition of $H_2S$. (DLC)

**22365 Inhibition of chemical reactions by a strong laser field.** Kulander, K.C.; Orel, A.E. (Theoretical Atomic and Molecular Physics Group, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). W-7405-ENG-48. *Journal of Chemical Physics, The ;* **74**: No. 11, 6529-6530(1 Jun 1981).

Collinar model systems are described for reactions in a Stong laser field. $H+H_2$ reaction and Li+FH reaction are discussed. The reaction probability is calculated in both cases. (AIP)

**22366 Kinetics of the formation of hydroxylamine disulfonate by reaction of nitrite with sulfites.** Oblath, S.B.; Markowitz, S.S.; Novakov, T.; Chang, S.G. (Lawrence Berkeley Lab., CA). Contract W-7405-ENG-48. *Journal of Physical Chemistry, The ;* **85**: No. 8, 1017-1021(16 Apr 1981).

The reaction between nitrite and bisulfite to form hydroxylamine disulfonate has been investigated in weakly acidic solutions (pH 4.5 to 7) and found to consist of three concurrent processes. The reaction rate law can be expressed as d[HADS]/dt = $k_0[H^+]^2[NO_2^-]$ + k/sub I/$[H^+][NO_2^-][HSO_3^-]$ + k/sub II/ $[NO_2^-][HSO_3^-]^2$. The values for the specific rate constants $k_0$, k/sub I/, and k/sub II/ (at 295 K and $\mu$ = 1.20) are 8 x $10^5$, 3.8 x $10^3$, and 9.6 x $10^{-3}$ $L^2/(mol^2 s)$ respectively. The dependence of the rate constants k/sub I/ and k/sub II/ on temperature and ionic strength were investigated. A reaction mechanism has been proposed which is consistent with these results. The rate constants for the three rate-determining steps in this mechanism have been calculated.

**22367 Effect of water upon the critical points of carbon dioxide and ethane.** Morrison, G. (National Bureau of Standards, Washington, DC). Contract P7901196. *Journal of Physical Chemistry, The ;* **85**: No. 7, 759-761(2 Apr 1981).

At the end of the critical locus for $CO_2$ + $H_2O$, x/sub $H_2O$/ = 1.1 x $10^{-3}$, the critical temperature of $CO_2$ is raised 0.375 K. For $C_2H_6$ + $H_2O$, the critical temperature of $C_2H_6$ is lowered 0.022 K at the end of the critical locus, x/sub $H_2O$/ = 5.5 x $10^{-4}$.

**22368 Isotope effects in the lanthanum dihydrides.** Carstens, D.H.W. (Los Alamos National Lab., NM). *Journal of Physical Chemistry, The ;* **85**: No. 7, 778-782(2 Apr 1981).

Equilibrium pressures of protium, deuterium, and tritium over lanthanum metal at atomic ratios up to 2.2 have been measured for temperatures ranging from ~ 800 K to slightly over 1000 K. The equilibrium pressures in the plateau regins increased as expected from the protide to the deuteride to the tritide. Sieverts' constants were determined at the higher temperature and decreased in this same order. Within experimental error the terminal solubilities of the three isotopes in the metal, defined by the separation of the dihydride phase from the metal, are the same.

**22369 Reaction kinetics of nitrogen dioxide with liquid water at low partial pressure.** Lee, Y.N.; Schwartz, S.E. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry, The ;* **85**: No. 7, 840-848(2 Apr 1981).

The reaction $2NO_2(g) + H_2O(l) \rightarrow 2H^+ + NO_3^- + NO_2^-$ (l) has been studied for 1 x $10^{-7} \leqq$ P/sub NO2/ $\leqq$ 8 x $10^{-4}$ atm. Since this reaction involves the transfer of a reactant from the gas into the aqueous phase, the rate depends upon the following: (a) physical mass transfer of the reactant, (b) the equilibrium solubility of $NO_2$, and (c) homogeneous aqueous-phase kinetics. In order for the observed rate to yield information most sensitive to (c), the rate of (a) must be comparable to that of (c). In the case of a second-order reaction, this can be achieved by working at low partial pressure of $NO_2$ as well as a high rate of physical mixing of the two phases. To facilitate the latter, the gas was brought into contact with the liquid as finely dispersed bubbles produced by flowing through a disk-frit; the mass transfer time constant, determined by uptake of $CO_2$, was tau/sub m/ = 1.7 to 5.3 s. The rate of reaction 1, monitored by observing the electrical conductivity of the aqueous solution, exhibited dependence on p/sub NO2/ and tau/sub m/ consistent with second-order kinetics and a steady-state aqueous-phase $NO_2$ concentration. Values of H/sub NO2/, the Henry's law coefficient, and $k_1$, the second-order aqueous-phase rate constant, were determined to be (7.0 +- 0.5) x $10^{-3}$M $atm^{-1}$ and (1.0 +- 0.1) x $10^8 M^{-1}s^{-1}$, respectively, at 22°C. Self-consistency of the gas-liquid reaction model has been demonstrated in terms of the identity of the diffusing species and the extent of mass-transport limitation.

**22370 Particle size determination in supported $\alpha$-$Fe_2O_3$.** Amelse, J.A. Hill; Arcuri, K.B.; Butt, J.B.; Matyi, R.J.; Schwartz, L.H.; Shapiro, A. (Bell Labs., Murray Hill, NJ). Contract AC02-78ER04993. *Journal of Physical Chemistry, The ;* **85**: No. 6, 708-711(19 Mar 1981).

The techniques of high-angle x-ray diffraction line profile analysis, transmission electron microscopy, and Moessbauer effect spectroscopy have been applied to the study of $\alpha$-$Fe_2O_3$ supported on silica gel. It is shown that (1) significant overestimates of particle size are made by using the Scherrer line breadth analysis of the x-ray data (e.g., 180 A vs. 100 A with line profile analysis); (2) the x-ray particle size, characteristic of the average coherently diffracting domain size, may have little relation to the actual exposed surface area when extensive crystal imperfection is present; (3) Moessbauer spectral determination of particle size via analysis of superparamagnetic fraction should be recalibrated by using the value of magnetocrystalline anisotropy K = 3.5 x $10^5$ erg/$cm^3$; and (4) transmission electron microscopy is a critical adjunct to either of the other two techniques (Moessbauer and x-ray) in establishing the extent of crystalline imperfection of particles.

**22371 Alkyl-metal and aryl-metal bond chemistry in coordinately unsaturated polynuclear metal complexes.** Schmidt, G.F. (Univ. of California, Berkeley); Muetterties, E.L.; Beno, M.A.; Williams, J.M. *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 3, 1318-1320(Mar 1981).

A new class of coordinately unsaturated polynuclear rhodium and iridium alkyl, benzyl, and aryl derivatives of the form [RM(1,5-cyclooctadiene)]/sub x/ have been prepared by the reaction of the organolithium reagent with the cyclooctadiene-metal chlorides at -78°C. The x-ray crystal structure of [$\mu$-$CH_3$Rh(1,5-cyclooctadiene)]$_2$ is reported. The analogous iridium dimer decomposes by an initial sequence of $\alpha$-hydrogen abstraction and then reductive elimination of hydrogen to give [$\mu$-$CH_2$Ir(1,5-cyclooctadiene)]$_2$. Formed in high yield by the decomposition of the ethylrhodium complex was [HRh($C_8H_{11}$)]$_4$, a tetrahedral cluster with face-bridging hydride ligands. Also discussed are the reactivities of the benzyl and phenyl derivatives. Unique reaction pathways for C-H bond activation and scission in this chemistry are delineated.

**22372 Stochastic flows in integral and fractal dimensions and morphogenesis.** Hatlee, M.D.; Kozak, J.J. (Univ. of Notre Dame, IN). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 2, 972-975(Feb 1981).

The effect of dimensionality and spatial extent on the dynamics of an irreversible reaction confined to a finite system was studied by a Monte Carlo simulation. Stochastic flows on surfaces of integral and fractal dimensions and the consequences of reducing the dimensionality of the reaction space are described. As regards the timing and efficiency of chemical reactions in small systems, our simulations show that placing the reactive site at a central location may be favored at an early stage of growth but, as the system evolves in size, a location on the boundary becomes favored. The possible relevance of these calculations to the problem of morphogenesis is brought out.

**22373 Structure of cerium orthophosphate, a synthetic analogue of monazite.** Beall, G.W.; Boatner, L.A. (Oak Ridge National Lab., TN (USA)); Mullica, D.F.; Milligan, W.O. (Baylor Univ., Waco, TX (USA)). *Journal of Inorganic and Nuclear Chemistry ;* **43**: No. 1, 101-105(1981).

The crystal structure of $CePO_4$ has been determined by modern X-ray crystallographic techniques. The unit cell is monoclinic (space group $P2_1/n$) with a = 6.777(3), b = 6.993(3), c = 6.445(3) A, and $\beta$ = 103.54(4)°. The final least-squares refinement yielded R = 0.0276, and Rsub(w) = 0.0280. The structure is made up of irregular 9-coordinated cerium atoms linked together by distorted tetrahedral phosphate groups. Comparisons with previous structural determinations of natural monazites are made. A potential application of the lanthanide orthophosphates as a nuclear waste matrix material is briefly discussed.

**22374 Hydrogen isotope gettering with yttrium metal.** Begun, G.M.; Land, J.F.; Bell, J.T. (Oak Ridge National Lab., TN (USA)). *Journal of the Less-Common Metals ;* **74**: No. 2, 321-322(15 Oct 1980).

From International symposium on the properties and applications of metal hydrides; Colorado Springs, CO, USA (7 - 11 Apr 1980).

Published in summary form only.

**22375 Hydrogen and deuterium sorption by selected rare earth intermetallic compounds at pressures up to 1500 atm.** Lakner, J.F.; Uribe, F.S.; Steward, S.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Journal of the Less-Common Metals ;* **74**: No. 1, 13(1 Oct 1980).

From International symposium on the properties and applications of metal hydrides; Colorado Springs, CO, USA (7 - 11 Apr 1980).

Published in summary form only.

**22376 Lanthanide and actinide chemistry and spectroscopy.** Edelstein, N.M. (ed.). Washington, DC; American Chemical Society (1980). 479p. (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

Twenty chapters are grouped according to three main subheadings: organoactinide and organolanthanide chemistry; complex chemistry, thermodynamic properties, and transcurium chemistry; and electronic structure and spectroscopy. Separate abstracts were prpared for 16 chapters; the remaining four had been previously abstracted. (DLC)

**22377 Lanthanide and actinide lasers.** Weber, M.J. (Univ. of California, Livermore). Contract W-7405-ENG-48. *ACS (American Chemical Society) Symposium Series ;* No. 131, 275-311(1980). (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

Stimulated emission has now been observed from twelve lanthanide ions and one actinide ion. Host media have included crystalline and amorphous solids, metallo-organic and inorganic aprotic liquids, and metal and molecular vapors. Laser action spans a spectral range from approximately 0.3 to 4.0 $\mu$m and involves electronic and phonon-assisted 4f-4f, 5d-4f, and 5f-5f transitions. The lanthanides have enjoyed their greatest utilization in optically-pumped solid-state lasers; sizes range from thin films and small fibers for integrated optics applications to large rods and disks in high-power glass lasers for fusion experiments. The spectroscopic properties which distinguish the operation of lanthanide and actinide lasers in various hosts are reviewed. Recent results and possible future directions to exploit the unique characteristics of lanthan-

ide and actinide elements for lasers are also discussed. 120 references, 7 figures, 4 tables.

**22378 Optical properties of actinide and lanthanide ions.** Hessler, J.P.; Carnall, W.T. (Argonne National Lab., IL). *ACS (American Chemical Society) Symposium Series ;* No. 131, 349-368(1980). (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

This paper reviews some of the recent developments in this area of spectroscopy, emphasizing the optical properties of the tripositive lanthanide and actinide ions. In particular, the single ion properties of line positon, intensity, width, and fluorescence lifetime are discussed. 53 reference, 3 figures, 4 tables.

**22379 Infrared spectra of carbon monoxide on evaporated nickel films: a low temperature thermal detection technique.** Bailey, R.B.; Iri, T.; Richards, P.L. (Lawrence Berkeley Lab., CA). Contract W-7405-ENG-48. *Surface Science ;* **100**: 626-646(1980).

A novel thermal detection scheme has been developed and combined with the techniques of rapid scan Fourier transform infrared spectroscopy to make sensitive, high resolution measurements of the vibrational spectrum of carbon monoxide molecules on evaporated nickel films. Adsorbed molecules are detected by attaching a germanium resistance thermometer to the sample, cooling the assembly to liquid helium temperatures, and measuring the temperature changes which occur when infrared radiation is absorbed. Spectra are pesented for a range of CO coverages on an evaporated nickel film and a film damaged by ion bombardment. The positions, shapes, and intensities of the spectral lines from linear and bridge bonded CO molecules give information about the surface structure of the metal films and about the different ordered phases of the adsorbed molecules.

**22380 Muonium chemistry: a review.** Fleming, D.G. (Univ. of British Columbia, Vancouver); Garner, D.M.; Vaz, L.C.; Walker, D.C.; Brewer, J.H.; Crowe, K.M. *Advances in Chemistry Series ;* No. 175, 279-334(1979).

The muonium atom can properly be regarded as an ultralight isotope of hydrogen, in which the proton nucleus is replaced by a positive muon of only one-ninth its mass. Within the Born-Oppenheimer approximation, the chemical identical up to differences in reaction dynamics; thus, muonium chemistry studies greatly extend the range of observable mass-sensitive effects in chemical kinetics. The theoretical background of muonium chemistry is presented and applied to thermal kinetic studies in both gas- and liquid-phase systems, drawing on current experimental results which reveal both normal and inverse dynamic isotope effects. Associated phenomena such as muonium hot atom reactions are also discussed.

## 4003 Organic Chemistry

*REFER ALSO TO CITATION(S) 21496, 21507, 22326, 22349, 22372, 22392, 22394, 22698*

**22381 Long range transfer of positive charge between dopant molecules in a rigid glassy matrix.** Miller, J.R.; Beitz, J.V. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). W-31-109-ENG-38. *Journal of Chemical Physics, The ;* **74**: No. 12, 6746-6756(15 Jun 1981).

Pulse radiolysis has been used to observe and measure the kinetics for intermolecular positive charge (hole) transfer from biphenyl$^+$ or pyrene$^+$ ions to TMPD molecules in rigid 2-chlorobutane glass at 77 K. These hole transfers occur over distances of about 17 A at $10^{-6}$ s, increasing to about 34 A at $10^2$ s. The kinetic data are interpreted in terms of current theories which treat electron transfer processes as radiationless transitions. Estimates of the required electron exchange interactions based on the usual electron tunneling models can not explain the fast reactions observed, even when Coulombic effects on the "barrier" are considered. A superexchange model is proposed which involves interactions propagated by both negative and positive ion states of the solvent. This model adequately interprets the data in terms of a dominant role of the solvent positive ion states, and is also applicable to negative charge transfer in the condensed phase. In samples containing only one solute (biphenyl or pyrene), ion recombination with $Cl^-$ removed about one third of the positive ions of the solute between $10^{-6}$ and $10^2$ s. The data on intermolecular hole transfer between two solutes must be corrected for the effects of ion recombination. The correction is simple and quantitative only when it is possible to observe decay of the reactants without substantial spectral overlap from the products. Because the effects of ion recombination on product growths are complex, it is not presently possible to use the growths to measure reliably the kinetics intermolecular positive charge transfer.

**22382 Photoelectron spectroscopy of carbonyls: saturated normal dicarboxylic acids.** Chattopadhyay, S.; Meeks, J.L.; Findley, G.L.; McGlynn, S.P. (Louisiana State Univ., Baton Rouge). *Journal of Physical Chemistry, The ;* **85**: No. 8, 968-970(16 Apr 1981).

The ultraviolet photoelectron spectra (UPS) of oxalic, malonic, succinic, glutaric, and adipic acids, and various of their simple derivatives, are presented and discussed. The four lowest-energy ionization events, [I(n/sub +/), I(n/sub -), I ($\pi$/sub +/), I($\pi$/sub -/)], are assigned in all cases. Higher ionization events are not assigned because of molecule-limited resolution in the higher-energy UPS region.

**22383 Methylene singlet-triplet separation: an explicit variational treatment of many-body correlation effects.** Saxe, P. (Univ. of California, Berkeley); Schaefer, H.F. III; Handy, N.C. *Journal of Physical Chemistry, The ;* **85**: No. 7, 745-747(2 Apr 1981).

The electronic structure of $CH_2$ has been addressed by use of theoretical techniques which allow for the variational inclusion of large classes of excitions differing by more than two electrons from the Hartree-Fock description. Specifically, a natural orbital transformation has been used to define orbitals for a full configuration interaction (CI) within the valence electron space. These full valence CI's include 56 configurations for $^1A_1$ methylene and 51 configurations for $^3B_1CH_2$. Subsequently all single and double excitations with respect to all configurations in the full valence are included in the final variation treatments, which involved 57,684 configurations ($^1A_1$) and 84,536 configurations ($^3B_1$).

**22384 Temperature dependence of the luminescence lifetimes of halopentaammine- and hexaamminerhodium(III) compounds in the solid state.** Bergkamp, M.A.; Watts, R.J.; Ford, P.C. (Univ. of California, Santa Barbara). *Journal of Physical Chemistry, The ;* **85**: No. 6, 684-686(19 Mar 1981).

Reported are the luminescence lifetimes of $[RhA_5X](ClO_4)$/sub n/ (A = $NH_3$ or $ND_3$; X = $Cl^-$, $Br^-$, A) in the solid state at nine temperatures between 85 and 295 K. The lifetimes were in the microsecond range and the individual compounds exhbited variations of as great as a factor of ~ 200 and as small as a factor of ~ 7. The lifetime data are empirically fit to a two-term rate law; $tau^{-1} = A + A' \exp(-\Delta E/RT)$. The origin of the temperature dependence is discussed in terms of weak and strong coupling deactivation mechanisms or alternatively a deactivation process involving two thermally equilibrated spin-orbit coupled components of the ligand-field states.

**22385 Restricted rotation in hydroxyphenyl ketones and formaldehydes.** Antypas, W.G. Jr. (Williams Coll., Williamstown, MA); Siukola, L.V.M.; Kleier, D.A. *Journal of Organic Chemistry, The ;* **46**: No. 6, 1172-1177(13 Mar 1981).

Barriers to rotation about the carbonyl carbon to phenyl carbon bond in phenyl ketones and formaldehydes are determined by a detailed line-shape analysis of the proton magnetic resonances which arise from hydroxyl groups substituted at the 2- and 6-positions of the phenyl ring. Enthalpies of activation for 2,4,6 derivatives of benzaldehyde and acetophenone are determined to be 8.0 and 6.9 kcal/mol, respectively. Although full line-shape analyses were not possible for the 2,6-dihydroxy derivatives of benzaldehyde and acetophenone, activation enthalpies are estimated to have upper limits of 6 kcal/mol. The effects of intermolecular exchange on the hydroxyl resonances are also reported as a function of water concentration. The experimental barriers to internal rotation are then compared with those obtained by using molecular orbital theory at

the PRDDO level of approximation. Theoretical barriers are higher than experimental ones by at least 50%, suggesting significant solvent effects on the barriers.

22386 **Mild and convenient conversion of ketones to the corresponding methylene derivatives via reduction of tosylhydrazones by bis(benzoyloxy)borane.** Kalbalka, G.W.; Summers, S.T. (Univ. of Tennessee, Knoxville). *Journal of Organic Chemistry, The ;* **46**: No. 6, 1217-1218(13 Mar 1981).

The purpose of this study was to investigate reducing agents which are as versatile as catecholborane but which can be more readily prepared. It is reported that bis(benzoyloxy)borane ($(PhCO_2)_2BH$) effectively reduces tosylhydrazones to the corresponding methylene derivatives. The results parallel those obtaining using catecholborane.

22387 **Phosphorus-31 nuclear magnetic resonance as a method of predicting ligand basicity and rates of homogeneous catalysis.** Derencsenyi, T.T. (Raychem Corp., Menlo Park, CA). Contract W-7405-ENG-48. *Inorganic Chemistry ;* **20**: No. 3, 665-670(Mar 1981).

Variations in CPC bond angles caused by bulky substituents on phosophines change the shielding on the phosphorus nucleus and can often mask correlations between chemical reactivity and $^{31}P$ NMR chemical shifts. With use of the chemical shift of the tetrahedral oxide of the parent compound the steric effects are minimized, thus allowing the chemical shift to provide successful correlations with the reactivity of the parent compound. Group contribution effects of the substituents attached to phosphorus suggest a new linear free energy relationship, and the direct relationship between reactivity and chemical shift of the phosphine oxide can aid in the choice of ligands for homogeneous catalysis. The correlations of the chemical shift of the phosphine oxides with ligand basicity and infrared and NMR data of metal-phosphine complexes indicate the influence of both $\sigma$ and $\pi$ bonding between the metal and the phosphine ligands.

22388 **Organochromium(III) complexes derived from nitriles.** Funke, L.A.; Espenson, J.H. Contract W-7405-ENG-82. *Inorganic Chemistry ;* **20**: No. 3, 897-899(Mar 1981).

Reactions of chromium(II) perchlorate with acidified solutions of hydrogen peroxide in water containing modest concentrations of an organic nitrile (RCN) give rise to the cationic organochromium complexes $CrCH_2CN^{2+}$ (RCN = acetonitrile), $CrCH_2CH_2CN^{2+}$ (propionitrile), and $CrCH_2CH(CH_3)CN^{2+}$ (isobutyronitrile). These cyanoalkyl complexes are quite resistant to decomposition in aqueous perchloric acid and can be separated by ion-exchange chromatography. Their composition was established by identification of the organic bromide formed by reaction with aqueous bromine. The complexes react with $Hg^{2+}$ first to form the corresponding $HgR^+$ and then (if excess organochromium is present) $HgR_2$. Kinetic studies for the first stage of this reaction were carried out. The data are consistent with a bimolecular electrophilic substitution process (S/sub E/2 mechanism).

22389 **$^{15}N$ NMR study of complexation of 1-methylimidazole by zinc(II) and cadmium(II) in aqueous soltuion.** Alei, M. Jr.; Morgan, L.O.; Wageman, W.E. *Inorganic Chemistry ;* **20**: No. 3, 940-942(Mar 1981).

The $^{15}N$ NMR study of complexation of 1-methylimidazole (1-MeIM) with $Zn^{2+}$ or $Cd^{2+}$ was undertaken to predict more accurately the effects of metal complexation on imidazol-ring $^{15}N$ shifts in biological systems when the two nitrogens are usually distinguishable. The data indicated that complexation of 1-MeIM by both metals led to a large upfield shift at $^{15}N_3$ and an order of magnitude smaller downfield shift at $^{15}N_1$. Also, earlier observations that replacement of a proton by a methyl group at $N_1$ does not greatly alter the $^{15}N$ NMR properties of the imidazole-ring nitrogens are substantiated. The data for the $^{15}N_3$ shift in the two systems correlate well with expected relative magnitudes and trends in the stepwise intrinsic formation constants for the complex systems, but the data are not sufficiently precise to establish values or trends for the stepwise formation constants. (BLM)

22390 **Extended x-ray absorption fine structure of copper in cytochrome c oxidase: direct evidence for copper-sulfur ligation.** Scott, R.A. (Stanford Univ., CA); Cramer, S.P.; Shaw, R.W.; Beinert, H.; Gray, H.B. *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 2, 664-667(Feb 1981).

The copper x-ray fluorescence excitation spectrum of cytochrome c oxidase (ferrocytochrome c:oxygen oxidoreductase, EC 1.9.3.1) has been recorded in the 245 to 270 K range. The beat pattern observed in the extended x-ray absorption fine structure can be accounted for only by postulating a combination of sulfur and nitrogen (or oxygen) ligands to the copper. The average Cu-S distance is 2.27 +- 0.02 A and the average Cu-N (or Cu-O) distance is 1.97 +- 0.02 A. The amplitudes require ca. 1-1.5 sulfurs and 2 nitrogens (or oxygens) per copper. The distribution of sulfur ligands between Cu/sub A/ and Cu/sub B/ sites is not known, although there is some evidence that two sulfur atoms are bound to Cu/sub A/.

22391 **Study of liquid crystal conformation by multiple quantum NMR: n-pentyl cyanobiphenyl.** Sinton, S.; Pines, A. (Lawrence Berkeley Lab., CA). Contract W-7405-ENG-48. *Chemical Physics Letters ;* **76**: No. 2, 263-267(1 Dec 1980).

The multiple quantum NMR spectrum of 4-cyano-4'-n-pentyl-$d_{11}$-biphenyl in the nematic phase is presented. The subspectra of the higher quantum transitions are easier to interpret than the single quantum spectrum. A preliminary analysis of the biphenyl conformation indicates that the dihedral angle is 32 +- 1°.

## 4004 Electrochemistry

22392 **Electroanalytical chemistry of (carbon monoxy)heme.** Gurira, R.C.; Jordan, J. (Pennsylvania State Univ., University Park). Contract EG-77-C-01-4042. *Analytical Chemistry ;* **53**: No. 6, 864-867(May 1981).

Dissolution of ferriheme in water-ethanol mixtures buffered at pH 9 to 13 yields a hydroxo(ethanolato)hemichrome. When the heme-iron was electroreduced from the ferric to the ferrous state in the presence of carbon monoxide, one axial ligand, viz., hydroxyl, was concomitantly replaced by CO while the trans axial ligand (ethanol) remained unaffected. The electrogeneration of the relevant (carbonyl monoxy)-(ethanolato)hemochrome has been investigated by potentiometry, chronoamperometry, polarography, and cyclic voltammetry. The electrochemical rate constant (prevailing at the formal potential where k/sub ox/ = k/sub red/) was 0.001 cm $s^{-1}$ which is remarkably slow compared to other hemichrome-hemochrome redox couples. The sluggish electron transfer reactivity is accounted for by a change in spin multiplicity from the high-spin state of the hydroxy(ethanolato)hemichrome to be low-spin state of the (carbon monoxy)(ethanolato)-hemochrome.

## 4005 Photochemistry

*REFER ALSO TO CITATION(S) 21797, 21809, 22377, 22811*

22393 **(DOE/ER/04426—4) Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981.** Gordon, R.J. (Illinois Univ., Chicago (USA)). May 1981. Contract AS02-77ER04426. 26p. (COO—4426-4). NTIS, PC A03/MF A01.

The flash photolysis resonance (FP-RF) technique was used to reexamine the Cl-$H_2$ system, ($Cl + H_2 \rightarrow H + HCl$), to eliminate wall effects encountered in the flow reactor. With the FP-RF technique, the reactions takes place in the center of the cell at a rate which is typically two orders of magnitude faster than the rate of diffusion to the walls. Fromthis study, it was concluded that the ratio of the forward to the reverse rate constant is equal to the equilibrium constant. The measurement of the rate constant of the reaction $Cl + D_2 \rightarrow D + HCl$ was the second study carried out during FY 1981. Below 250°K, an anomalous departure from Arrhenius behavior in the equilibrium constant, K/sub D/, was observed. This was attributed to an impurity in the deuterium gas. While the possibility that some highly reactive impurity is responsible for the anomalous temperature cannot be completely ruled out, it does appear that the non-Arrhenius behavior is real. A possible

explanation of the data is that long range attractive forces increase the reactive cross section at low kinetic energies. For the faster $H_2$ this effect would occur only at lower temperatures.

22394 **(UCID—18509-80-1) Development of advanced technologies for photochemical tritium recovery. Quarterly progress report, January 1, 1980-March 31, 1980.** Herman, I.P.; Marling, J.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Apr 1980. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01.

Progress has been made in building the laboratory facility for photochemical tritium separation research. Initial IR photolysis experiments have been performed in $CDCl_3/CHCl_3$ to better understand the photochemistry in the $CTCl_3/CDCl_3$ system anticipated to be useful in photochemical tritium recovery.

22395 **Heat of formation of $C_2H^+$.** Ono, Y.; Ng, C.Y. (Ames Laboratory, U. S. Department of Energy, and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics, The ;* **74**: No. 12, 6985-6986(15 Jun 1981).

The heat of formation of $C_2H^+ \rightarrow C_2H^+ + H$ is considered.(AIP)

22396 **Laser-flash-induced dissociation and recombination of aqueous pentacyano (2-methylpyrazine)ferrate(II) ion.** Malin, J.M. (Univ. of Missouri, Columbia); Brunschwig, B.S.; Brown, G.M.; Kwan, K.S. *Inorganic Chemistry ;* **20**: No. 5, 1438-1441(May 1981).

Metal-to-ligand charge transfer (MLCT) excitation of pentacyano(2-methylpyrazine)ferrate(II) ion in solution has been investigated, employing pulsed laser light of wavelengths 440 to 530 nm. Bleaching of the MLCT absorption due to loss of the heterocycle occurs in less than 20 ns. In the presence of excess heterocycle the starting material is regenerated via two intermediates, characterized by their substitution kinetics. One of the intermediates is the ion pentacyanoaquaferrate(II), for which the rates of recombination with 2-methylpyrazine were measured in the concentration range 0.0025 M $\leqq$ [2-Mepyr] $\leqq$ 9.6 M. The rate law for the process when [2-Mepyr] $\leqq$ 1 M is rate = k/sub f/[$Fe(CN)_5OH_2^{3-}$][2-Mepyr] (k/sub f/ = 475 +- 25 $M^{-1}$ $s^{-1}$, 25°C, $\mu$ = 0.1 M LiTFMS, $\Delta H^{++}$ = 16.0 +- 0.3 kcal/mol, $\Delta S^{*}$ = 7.7 +- 1 cal $mol^{-1}$ $deg^{-1}$). The rate of this reaction is independent of pH in the range 6.6 $\leqq$ pH $\leqq$ 11.4. At [2-Mepyr] > 1 M the apparent order in that reagent's concentration increases markedly. The second intermediate decays via a much smaller absorbance change than the first and exhibits a tendency toward rate saturation in its substitution kinetics. This species is identified tentatively as the sterically hindered N-1 isomer of pentacyano(2-methylpyrazine)ferrate(II).

22397 **Laser excitation of $SF_6$ in a transparent nozzle beam: collision-assisted absorption and up-pumping.** Lester, M.I. (Columbia Univ., New York, NY); Coulter, D.R.; Casson, L.M.; Flynn, G.W.; Bernstein, R.B. Contract AS02-ER-78-S-02-4940. *Journal of Physical Chemistry, The ;* **85**: No. 7, 751-753(2 Apr 1981).

Irradiation of $SF_6$ in a transparent capillary-nozzle supersonic beam source by a low-power cw $CO_2$ laser has provided molecular beams with a laser-induced increase in total energy of ~ 0.6 eV $molecule^{-1}$ (corresponding to the absorption of approximately five laser photons). Some 80% of this energy increase is retained as internal excitation of $SF_6$.

22398 **Electron transfer in the quenching of protonated triplet methylene blue by ground-state molecules of the dye.** Kamat, P.V.; Lichtin, N.N. (Boston Univ., MA). *Journal of Physical Chemistry, The ;* **85**: No. 7, 814-818(2 Apr 1981).

A Q-switched pulsed ruby laser emitting at 694.3 nm was used in an investigation by means of flash photolysis-kinetic spectrophotometry of the mechanism of quenching of the monoprotonated lowest triplet state of methylene blue, $^3MBH^{2+}$, by the ground state of the dye, $MB^+$. Quenching in 0.01 N acid is accompanied by electron transfer to give the half-oxidized and half-reduced ion radicals, $MB^{2+}$. and $MBH^+$.. The absorption spectrum of $MB^{2+}$. has been characterized in several media from 360 to 600 nm. The rate constant for quenching, k/sub q/, varies with solvent, ionic strength, and nature of anions with values around 1 x $10^8$ $M^{-1}$ $s^{-1}$ in water, aqueous $CH_3CN$, and aqueous EtOH. The efficiency of net electron transfer in quenching, $F_1$(= k/sub et//k/sub q/), varies with solvent but is independent of the ionic strength or the nature of the anions. $F_1$ varies inversely with polarity of the solvent from 0.055 in water to 0.48 in 90% (vol/vol) aqueous $CH_3CN$. On the basis of analogy to the behavior of a number of other quenchers and the observed linear variation of the function ln [(1/$F_1$)-1] with Kosower's polarity parameter Z, it is suggested that reversible electron transfer is the only significant mechanism of quenching of $^3MBH^{2+}$ by $MB^+(S_0)$. Both $MBH^+$. and $MB^{2+}$. decay by second-order processes in solvents containing 75% (vol/vol) or less of organic component but the specific rates are different for the two species in most media. It is suggested that in the latter media both cross reaction of $MBH^+$. with $MB^{2+}$. and biomolecular reaction of two molecules of the same radical occur. This study shows that ground-state quenching can significantly reduce the sunlight engineering efficency of photogalvanic conversion in systems incorporating relatively concentrated dyes.

22399 **ESR study of electron reactions with carboxylic acids, ketones, and aldehydes in aqueous glasses.** Sevilla, M.D.; Swarts, S.; Bearden, R.; Morehouse, K.M.; Vartanlan, T. (Oakland Univ., Rochester, MI). *Journal of Physical Chemistry, The ;* **85**: No. 7, 918-923(2 Apr 1981).

Electron reactions with a number of carboxylic acids, ketones, and aldehydes were investigated in a deuterated neutral aqueous glass at 77 K by ESR spectroscopy. Free radical reactions which took place upon warming the glasses to temperatures at which the electron adducts become mobile were studied. For carboxylic acids (C/sub n/H/sub 2n+1/$CO_2$D, n = 2,3) the deuterated anion radicals ($RCH_2C(OD)_2$) give results which suggest abstraction of a hydrogen from the parent acid to produce radicals of structure $RCHCO_2D$. The formic acid deuterated anion is found to undergo a similar mechanism. The acetic acid deuterated anion is not found to abstract from acetic acid, but is found to abstract from isopropyl alcohol. Ketone electron adducts are also found to abstract from their parent compounds to yield radicals of structure RCHC(O)R′ with R and R′ = $CH_3$, $C_2H_5$. Electron reactions with five aldehydes (RCHO with R = H, $CH_3$, $C_2H_5$, $C_3H_7$, and i-$C_3H_7$) gave their corresponding alcohol radicals (RCHOD) after deuteration at 77 K. Radicals with R = $C_2H_5$, $C_3H_7$, and i-$C_3H_7$ were found to abstract from the parent aldehyde to form radicals of structure RR′CCHO. The methanol radical ($CH_2OD$) showed no further reaction while the ethanol radical ($CH_3CHOD$) resulted in the production of the diacetal anion. The results for acids, aldehydes, and ketones show that radicals of structure RC(OD)R′ with R′ = OD, H, or an alkyl group can act as hydrogen atom abstracting agents.

22400 **ESR study of electron reactions with esters and triglycerides.** Sevilla, M.D.; Morehouse, K.M.; Swarts, S. (Oakland Univ., Rochester, MI). *Journal of Physical Chemistry, The ;* **85**: No. 7, 923-927(2 Apr 1981).

Reactions which occurred after electron attachment at 77K to a number of small carboxylic acid esters and triglycerides in an aqueous glass are reported. Most ester anions are found to decay on warming to form alkyl radicals by $\beta$ scission: $RC(O^-)OR' \rightarrow RCO_2^- + R'$.. The alkyl radical (R′.) produced by annealing is found to abstract hydrogen from the parent ester at an $\alpha$-carbon site, R′.+ $R''CH_2CO_2R' \rightarrow R''CHCO_2R'$, or in the case of ethyl formate from the formate hydrogen, $CH_3CH_2.$+ $HCO_2C_2H_5 \rightarrow C_2H_6$ +.$CO_2C_2H_5$. Results found for the methyl formate anion suggest hydrogen abstraction by the anion itself may compete with alkyl radical formation. The anion of the triglyceride triacetin is found to undergo an analogous mechanism to the ester anions producing the propane diol diester radical, .$CH_2CH(Ac)CH_2(Ac)$, Ac = acetate. This species subsequently abstracts hydrogen from the parent compound to produce the $\alpha$-carbon radical, .$CH_2CO_2R$. Results found after annealing the tripropionin radical anion give evidence for abstraction from the $\alpha$ carbon in the propionate side groups producing $CH_3CHCO_2R$. Studies of a $\gamma$-irradiated ester (ethyl myristate) and two triglycerides (tripalmitin and tristearin) yield results which suggest that the mechanism of ester anion decay found in aqueous glasses applies to $\gamma$-irradiated neat long-chain esters and triglycerides. Results found in this work are compared to the results of product analysis.

**22401 Spatial mapping of concentrations in pulsed and continuous atom sources.** Steenhoek, L.E.; Yeung, E.S. (Iowa State Univ., Ames). Contract W-7405-ENG-82. *Analytical Chemistry ;* **53**: No. 3, 528-532(Mar 1981).

The high collimation of a laser beam is used to provide spatial information when it is imaged on a silicon vidicon, the high monochromaticity of the laser light is used to selectively monitor atomic and molecular species, and a Bragg cell is used to provide temporal resolution. These principles combined led to a versatile diagnostic scheme for studying pulsed and continuous sources for atomic and molecular spectrometry.

**22402 Ultraviolet laser photochemistry of $CF_2Cl_2$.** Tiee, J.J.; Wampler, F.B.; Rice, W.W. (Los Alamos Scientific Lab., NM). *Chemical Physics Letters ;* **68**: No. 2,3, 403-406(15 Dec 1979).

The focused ArF laser irradiation of $CF_2Cl_2$ at room temperature has been investigated and emission from the $CF(A^2\Sigma^+\text{-}CHI^2\pi)$,$CF(B^2\Delta\text{-}CHI^2\pi)$, and $CF_2(^1B_1\text{-}CHI^1A_1)$ systems has been found. Also, under conditions of a high pressure of Ar diluent, $C(^1P_1\text{-}^1S_0)$ emission has been noted.

**22403 Triplet energy migration in polymer photochemistry. A model for the photodegradation of poly(phenyl vinyl ketone) in solution.** Encinas, M.V.; Funabashi, K.; Scaiano, J.C. (Univ. of Notre Dame, IN). *Macromolecules ;* **12**: 1167-1176(Nov 1979).

Plots of the progress of the degradation of poly(phenyl vinyl ketone) as a function of irradiation time are nonlinear; the effect is the result of triplet quenching by unsaturated end groups generated in the reaction. The process in intramolecular, and from a study of polymers of different initial chain length and application of random walk theory for a one-dimensional lattice it is possible to determine the frequency of triplet energy hopping; the value obtained was ~ 1 x $10^{12}s^{-1}$ at 30°C in benzene. Poly(phenyl vinyl ketone) has a critical chain length of 750 units, this being the average number of chromophores visited by the excitation during the triplet lifetime.

## 4006 Radiation Chemistry

*REFER ALSO TO CITATION(S) 22400, 22798*

**22404 Reaction with metal ions of chloromethylated polystyrene resin containing dithiocarbamate group.** Hiratani, K.; Onishi, Y.; Nakagawa, T. (Industrial Products Research Inst., Ibaraki, Japan). *Journal of Applied Polymer Science ;* **26**: No. 5, 1475-1484(May 1981).

The derivatives of poly(chloromethylstyrene) resin (PCMS) with N-methyl-N-carboxylmethyldithiocarbamate (1), N,N-di($\beta$-hydroxyethyl)dithiocarbamate (2), N-methyl-N-carboxylmethylamino (3), and di($\beta$-hydroxyethyl)amino (4) groups were prepared, and the metal ion reactivity of the polymer resins with these functional groups were investigated. Additionally, the effect of $\gamma$ irradiation on the reaction with metal ion was also investigated. In the reaction of PCMS under the same conditions, the substitution ratio order is as follows: (2) > (1) > (4) > (3). In the reaction of the resins with cupric ion, the reaction amount reached a maximum of 4.17 mequiv/g for resin (1) and 4.75 mequiv/g for (2). The polymers containing sulfur atom have a large reactivity toward metal ion in comparison to the polymers without sulfur atom. The reactivity of polymer (1) toward metal ions decreased in the following order: Ag(I) >> Cu(II) > Zn(II)≧ Ni(II) ≧ Co(II). The other metal ions, except Ag(I) and Cu(II), hardly reacted with polymer (2). Thus, polymer (2) has a remarkable selectivity. It was also found that the reaction amount of polymers containing sulfur after $\gamma$ irradiation is almost the same as that before $\gamma$ irradiation.

**22405 ESR study of DNA base cation radicals produced by attack of oxidizing radicals.** Sevilla, M.D.; Suryanarayana, D.; Morehouse, K.M. (Oakland Univ., Rochester, MI). *Journal of Physical Chemistry, The ;* **85**: No. 8, 1027-1031(16 Apr 1981).

ESR investigations of $\gamma$-irradiated aqueous glasses (8 M $NaClO_4$, 12 M LiCl) containing DNA bases and analogues show that oxidizing species produced in the glasses (hydroxyl radicals and $Cl_2^-$) at 77 K attack a number of the bases and their analogues after warming to produce $\pi$-cation radicals. Compounds which produce $\pi$ cations include thymine, uracil, 3-methyluracil, 6-methyluracil, orotic acid, isoorotic acid, guanine, and adenine. Compounds which are not found to produce $\pi$ cations are 1-methylthymine, thymidine, and 1-methyluracil. The overall reaction for formation of the $\pi$ cations is as follows: base + $OH.(Cl_2^-) \rightarrow OH^-(2Cl^-)$ + base cation. A pH and substituent dependence is also noted for the pyrimidines. At pHs where the nitrogen at position 1 is protonated, $\pi$-cation radicals are not formed. In addition, when there are substituents at position 1, $\pi$ cations are not found. Analysis of the ESR spectra of the DNA base $\pi$ cations for hyperfine splittings and g values were performed by aid of computer simulations. The analyses are in agreement with values found for several DNA base cations produced by photolysis and by direct $\gamma$ irradiation.

**22406 Electron capture in water pools of reversed micelles.** Bakale, G. (Case Western Reserve Univ., Cleveland, OH); Beck, G.; Thomas, J.K. Contract AC02-78EV04726. *Journal of Physical Chemistry, The ;* **85**: No. 8, 1062-1064(16 Apr 1981).

The rate constants of excess electron attachment to reversed $H_2O$-AOT micelles in liquid isooctane were measured by a picosecond pulse-conductivity technique at 22°C. Electron attachment rates were less than the diffusion-controlled rate at molar ratios $\omega_0 = [H_2O]/[AOT]$ less than 12 but increased to the diffusion-controlled rate of ~ $10^{10}M^{-1}s^{-1}$ at $\omega_0$ = 37 where the micelle radius was ~ 100A. The transition from nondiffusion-controlled to diffusion-controlled electron attachment implies that free or non-AOT bound water in the micellar water pools is required for efficient electron attachment, which is consistent with earlier NMR, fluorescence, and polarization studies of electron capture by reversed $H_2O$-AOT micelles.

**22407 Intramolecular electron transfer and dehalogenation of anion radicals. 2. Halonitroaromatic compounds.** Behar, D.; Neta, P. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry, The ;* **85**: No. 6, 690-693(19 Mar 1981).

Halonitroaromatic compounds were reduced with e/sub aq/$^-$ or $(CH_3)_2COH$ in irradiated aqueous solutions to produce the anion radicals. The decay of these radicals follows either a bimolecular radical radical reaction or a unimolecular dehalogenation. The influence of the halogen location relative to the ring and the nitro group, and the effect of the C-halogen bond strength on the rates of the unimolecular dehalogenation were examined. p-$ClC_6H_4NO_2^-$, m-$BrC_6H_4NO_2^-$, o- and p-$IC_6H_4NO_2^-$, p-$BrCH_2CH_2C_6H_4NO_2^-$, p-$ClCH_2COOC_6H_4NO_2^-$, p-$ClCH_2CONHC_6H_4NO_2^-$, and p-$ClCH_2CH_2OCH_2CH_2OC_6H_4NO_2^-$ all decayed by second-order processes. The lack of dehalogenation reaction in these anion radicals is rationalized by high bond dissociation energies in the case of the halonitrobenzene radical anions, and by weak interactions of the halogen atom in the other compounds with the unpaired electron residing mainly on the nitrobenzene ring. p-$ICH_2COOC_6H_4NO_2^-$ decays unimolecularly with k = 30 $s^{-1}$ reflecting the low C-I bond strength. m- and p-$BrCH_2COC_6H_4NO_2^-$ decay in unimolecular processes with rates of 1.5 x $10^2$ and 4.1 x $10^4$ $s^{-1}$, respectively. These relatively high rates are rationalized by weakening of the C-Br bond by the CO group and by an effective bridging by the CO for intramolecular electron transfer.

**22408 Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis.** Bobrowski, K. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry, The ;* **85**: No. 4, 381-388(19 Feb 1981).

The primary reactions of hydrogen atoms, hydrated electrons, hydroxyl radicals, and oxide radical ions with benzyltrimethylammonium cations in aqueous solutions have been studied by the technique of pulse radiolysis. Hydrogen atoms react with the rate constant (2.0 +- 0.1) x $10^9$ $M^{-1}$ $s^{-1}$. The cyclohexadienyl-type radical decayed in a second-order process with a rate constant 2k = (4.8 +- 0.2) x $10^9$ $M^{-1}$ $s^{-1}$. Hydrated electrons react with a rate constant (4.3 +- 0.2) x $10^9$ $M^{-1}$ $s^{-1}$ to form benzyl radical. It has been concluded that irradiation of

benzyltrimethylammonium cations results in deamination brought about by hydrated electrons. Hydroxyl radicals react with benzyltrimethylammonium cation with a rate constant (5.0 +- 0.6) x $10^9$ $M^{-1}$ $s^{-1}$ to form the cyclohexadienyl-type radical $HOC_6H_5CH_2N^+(CH_3)_3$ (~ 65%) and $C_6H_5CHN^+(CH_3)_3$ (~ 35%) radicals. The cyclohexadienyl radical has a broad absorption maximum at 325 nm ($\epsilon \simeq 3300$ $M^{-1}$ $cm^{-1}$). Oxide radical ions react with the rate constant (5.9 +- 0.5) x $10^8$ $M^{-1}$ $s^{-1}$ to form $C_6H_5CHN^+(CH_3)_3$ with absorption maxima at 260 and 305 nm. With the increasing chain length of the alkyl substituent (as in the benzyltri-n-butylammonium cation) the reaction of hydrogen abstraction from the alkyl groups becomes more important.

## 4007 Radiochemistry And Nuclear Chemistry

*REFER ALSO TO CITATION(S) 22292, 22363, 22376, 22377, 22378, 22698*

**22409 Reactions of recoil $^{38}Cl$ in crystalline p-dichlorobenzenes.** Berei, K.; Ache, H.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Journal of Physical Chemistry, The ;* **85**: No. 8, 986-989(16 Apr 1981).

The effects of matrix structure on the chemical reactions occurring as the results of $^{37}Cl(n,\gamma)^{38}Cl$ in solid samples of p-dichlorobenzene were studied. No significant variations in the yields of the products formed were observed in the three phases $\alpha$,$\beta$, and $\gamma$ of p-dichlorobenzene. These and other results suggest that the $^{38}Cl$-labeled partent products are predominantly formed via hot $^{38}Cl$-for-Cl replacement reactions.

**22410 Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species.** Green, D.W. (Argonne National Lab., IL (USA). Chemical Engineering Div.). *Journal of Nuclear Materials ;* **88**: No. 1, 51-63(Jan 1980).

The relationship between thermodynamic functions derived from experimentally measured pressures and those calculated from spectroscopic data was examined quantiatively for the cases of UO, $UO_2$, $UO_3$, PuO, $PuO_2$, ThO, and $ThO_2$. Limitations have been determined for consistent values of $p(UO_2)$ over $UO_2(s)$, $\Delta H°sub(UO_2,0\ K)$, p(UO) over $UO_2(s)$ + U(l), $\Delta H°$ (0 K) for 1/2 $UO_2(s)$ + 1/2 U(e) → UO(g), $\Delta G°sub(f)(UO,g)$, $\Delta H°sub(f)(UO, g, 0\ K)$, $D°(UO, g\ 0\ K)$, $\Delta G°sub(f)(UO_3, g)$, $\Delta H°sub(f)(UO_3, g, 0\ K)$, the heat of atomization of $UO_3$, $\Delta G°sub(f)(PuO_2, g)$, $\Delta H°sub(f)(PuO_2, g, 298.15\ K)$, $\Delta G°sub(f)(PuO, g)$, $\Delta H°sub(f)(PuO, g, 298.15\ K)$, $\Delta G°sub(f)(ThO, g)$, $\Delta H°sub(f)(ThO, g, 218.15\ K)$, $\Delta G°sub(f)(ThO, g)$, $\Delta H°sub(f)(ThO_2, g, 298.15\ K)$, $\Delta H°sub(ThO_2, 298.15\ K)$, and the sublimation pressure of $ThO_2$.

**22411 Nuclear magnetic resonance studies of uranocenes.** Luke, W.D.; Streitwieser, A. Jr. (Lawrence Berkeley La., CA). Contract W-7405-ENG-48. *ACS (American Chemical Society) Symposium Series ;* No. 131, 93-140(1980). (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

The temperature dependent $^1H$ NMR spectra of uranocene and a varity of substituted uranocenes verify that uranocenes have effective axial symmetry and the pseudocontact contribution to the total isotropic shift is evaluated. In alkyl-substituted uranocenes, conformational analysis shows that a primary alkyl substituent populates principally conformations in which the dihedral angle between the substituent C/sub $\alpha$/ - C/sub B/ bond and the ring plane is close to 90° on the side of the ring away from the metal. X-ray analysis showed that substituents have ring-C/sub $\alpha$/ bonds tilted several degrees towards uranium. The ring proton resonances and steric considerations suggest that t-butyl and related substituents are tilted away from uranium. Both contact and pseudocontact interactions contribute to the observed isotropic shifts in uranocenes. The contact component is dominant for ring protons, but rapidly attenuates with increasing number of $\sigma$-bonds between the observed nucleus and the uranium such that the contact shift is effectively zero for B-protons. The value of the contact shift for ring protons in uranocene is of the same sign but about 10 to 15 ppM larger in magnitude than the contact shift for ring protons in $CP_3U$-X compounds. If a direct correlation exists between the magnitude of the contact shift and the degree of covalency in ligand-metal bonding in these systems, then the NMR data suggest a higher degree of covalency in the ligand-metal bonds in uranocene.

**22412 Techniques of microchemistry and their applications to some transcurium elements at Berkeley and Oak Ridge.** Peterson, J.R. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *ACS (American Chemical Society) Symposium Series ;* No. 131, 221-238(1980). (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

This paper gives an account of the microchemical methods that were developed for preparing and studying submilligram amounts of berkelium-249, californium-249, and einsteinium-253 and their compounds. The studies involved absorption spectrophotometry primarily, and also x-ray and electron diffraction. (DLC)

**22413 Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium.** Hulet, E.K. (Univ. of California, Livermore). Contract W-7405-ENG-28. *ACS (American Chemical Society) Symposium Series ;* No. 131, 239-263(1980). (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

Conclusions regarding these shifts toward greater stabilization of 5f orbitals with increasing atomic number are mainly supported by the appearance of the divalent oxidation state well before the end of the actinide series and the predominance of the divalent state in the next to last element in the series. These conclusions and the underlying experimental evidence are the main subject of this review.

## 4008 Combustion, Pyrolysis, And High-temperature Chemistry

*REFER ALSO TO CITATION(S) 21562, 21727*

**22414 (DOE/ET/10593—T1) Fundamentals of nitric oxide formation in fossil fuel combustion. Progress report, 29 June-28 September 1980.** Houser, T.; McCarville, M.E. (Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry). Dec 1980. Contract AC21-76ET10593. 21p. (FE—2018-18). NTIS, PC A02/MF A01.

The study of the oxidation kinetics of pyridine was completed in the temperature range of 948 to 1073°K and concentration ranges of 1.75 to 7.0 mole % oxygen; 0.25 to 2.0 mole % pyridine. The rate law is rate = $k(C_5H_5N)/sup\ 1/2/(0_2)(\Delta 0_2)/sup\ 1/2/$, where $\Delta 0_2$ is oxygen consumed (autocatalysis). The temperature dependence is k = 10/sup 14.7 +- .7/exp(-26600 +- 1600/T)(1/mole s). The yield of HCN appeared insensitive to changes in temperature, concentrations and equivalence ratio, and only trace amounts of nitrogen oxides and ammonia were found. Fuel-rich mixtures produced large amounts of smoke so that a nitrogen balance was not possible but for lean mixtures HCN and $N_2$ accounted for the product nitrogen. Increase to 2% pyridine and 14% oxygen produced reduced yields of HCN and increased yields of $N_2$, $N_2O$, and NO. $H_2$ had no influence on the rates of pyrolysis and oxidation of pyridine. At 1073°K HCN was oxidized at a measurable rate, added benzene increased the rate of oxidation at low equivalence ratios and reduced it at ratios above 0.9, with no significant nitrogen oxides produced, added acetylene increased the oxidation rate and also produced NO. It is clear that conditions can be found for the oxidation of heterocyclic nitrogen compounds that promote the formation of $N_2$ at the expense of NO.

**22415 (LBL—12141) Experimental study of the flowfield of a V-shaped premixed turbulent flame.** Cheng, R.K.; Ng, T.T. (Lawrence Berkeley Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 7p. (CONF-810704—4). NTIS, PC A02/MF A01.

From 1. international specialists meeting of the Combustion Institute; Bordequx, France (20 Jul 1981).

The flowfield of a V-shaped, premixed ethylene/air flame in grid induced turbulence has been studied using Laser Doubler Velocimetry. The experimental conditions covered free-stream veloci-

ties of 5 and 7 m/s and equivalence ratios ranging from 0.6 to 0.78. The two-dimensional velocity vectors obtained indicate that flow deflection in the free stream was significant and seemed to correlate with the flame angle. The influence of the flame holder wake on the flame was demonstrated. In the presence of the flame, an increase in the turbulence level in the free stream was found and was attributed to fluctuations in flow deflection induced by the fluctuating flame.

22416 **(LBL—12214) Modelling of burning and extinction characteristics of a polymer diffusion flame and comparison with experiment.** Pitz, W.J.; Sawyer, R.F. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 18p. (CONF-810713—1). NTIS, PC A02/MF A01.

From 1. international specialists' meeting of the Combustion Institute; Pittsburgh, PA, USA (20 Jul 1981).

The importance and contribution of the inherent flammability of polymeric materials to problems of fire safety is well recognized. This study was undertaken to provide a better understanding and interpretation of previous experimental investigations of polymer flammability. The structure of opposed flow diffusion flames has been measured by several investigators using both gaseous and solid fuels. The opposed flow diffusion flame is a convenient geometry for the study of the flammability of polymers because it allows both steady, diffusion controlled burning and extinction to be observed under well-controlled laboratory conditions. Conveniently available experimental parameters include fuel composition, oxidizer composition, and oxidizer blowing rate. Reported experiments generally have not included the variation of pressure or temperature. Radiation effects, which are important in fires, remain to be well-characterized in laboratory studies of opposed flow diffusion flames where radiation generally is of minor importance.

# 42 ENGINEERING

## 4202 Facilities And Equipment

*REFER ALSO TO CITATION(S) 21552, 21555, 22043, 22086, 22152, 22485, 22954*

22417 **(BDX—613-2620) Effect of workpiece edge angle on radius produced by vibratory finishing.** Gillespie, L.K. (Bendix Corp., Kansas City, MO (USA)). Jun 1981. Contract AC04-76DP00613. 16p. NTIS, PC A02/MF A01. Order Number DE81023772.

An investigation was conducted to determine the effect of the included edge angle upon the radius produced by vibratory finishing of small precision parts. Workpiece materials studied included phosphor bronze, 6061-T6 aluminum, and 303Se stainless steel. Edges having included angles smaller than 90° require finishing cycles up to 20 times longer than those having angles greater than 90°. The effect of the edge angle can be easily calculated.

22418 **(DOE/TIC—1022096) Ceramic heat pipe development. Semi-annual report, 1 October 1980-31 March 1981.** Merrigan, M. (Los Alamos National Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 23p. NTIS, PC A02/MF A01.

Progress is reported in the Ceramic Heat Pipe Development Program which is directed to the development of heat pipes for use in high-temperature heat exchangers. The development of ceramic heat pipe recuperator elements involves the selection and test of materials and fabrication techniques, subscale tests, design and test of components for full-scale recuperator applications, and demonstration of heat pipes in subscale and full-scale recuperator installations. Work on the program has involved the selection of candidate pipe envelope materials, working fluids, and protective liner materials based on temperature limits and compatibility considerations. Alumina-niobium-lithium and silicon carbide-tungsten-sodium combinations were selected for initial tests. The first successful operation of high temperature ceramic heat pipes was achieved using chemical vapor deposited (CVD) SiC as a container material and CVD tungsten as a protective liner. Controlled deposition of the tungsten was employed to give a textured surface for wicking. The working fluid used was sodium with the heat pipe closure accomplished by a tungsten-to-tungsten braze using a palladium-cobalt brazing alloy. These heat pipes were operated in air and in combustion gases at temperatures to about 1200°K. Peak-measured heat transfer through a 2.0-cm-diam heat pipe was about 2 kW with operational limits estimated to be higher.After about 100 h of operation and 30 cold starts, one of these pipes was sectioned and the tungsten-SiC interface examined for evidence of deterioration or reaction. The reaction zone thickness was found to be in agreement with predictive models developed on the program. However, some evidence of liner shell bond deterioration was observed, prompting a continuing investigation of improved fabrication methods.

22419 (LA—8797-PR, pp 65-70) **Heat pipe technology development.** Apr 1981. NTIS, PC A05/MF A01.

In Energy technology. Progress report, October-December 1980.

Progress in the Heat Pipe Technology Development program has involved continued development of in-house tungsten coating capability, ceramic seals, and surface oxide protected tubes for the ceramic heat pipe program. Limits of knurled wicks have been investigated under the gravity-assisted heat pipe engineering activity, and evaluation of sulfur as a heat pipe operating fluid has commenced.

22420 **(LA-UR—81-1038) Signal enhancement by spectral equalization of high-frequency broadband signals transmitted through optical fibers.** Ogle, J.W.; Lyons, P.B.; Holzman, M.A. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810429—16). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

A new technique is discussed for signal strength enhancement of high-frequency (>1 GHz), spectrally-broad, analog signals through 1 km of optical fiber. The conventional method for optical measurement of high-frequency gamma ray signals is to use an optical fiber placed in the gamma radiation beam as a Cerenkov transducer. The radiation-induced optical signal is degraded by material dispersion in transmission through the fiber. To reconstruct the signal (which is carried by each wavelength) and preserve the high-frequency components, a narrow-band filter selects an appropriate bandwidth (1 nm). The filtered signal is detected using a high-speed, microchannel-plate (MCP) photomultiplier detector and recorded on high-speed oscilloscopes.

22421 **(LA-UR—81-1084) Magnetic refrigeration for spacecraft systems.** Barclay, J.A. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 9p. (CONF-810715—1). NTIS, PC A02/MF A01.

From 11. inter-society conference on environmental systems; San Francisco, CA, USA (13 Jul 1981).

Magnetic refrigerators, i.e., those that use the magnetocaloric effect of a magnetic working material in a thermodynamic cycle, offer potentially reliable, and efficient refrigeration over a variety of temperature ranges and cooling powers. A descriptive analysis of magnetic refrigeration systems is performed with particular emphasis on more efficient infrared detector cooling. Three types of magnetic refrigerator designs are introduced to illustrate some of the possibilities.

22422 **(LA-UR—81-1316) New era for ultrasonic impact grinding.** Calkins, N.C. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 12p. NTIS, PC A02/MF A01.

New piezoelectric efficiencies allow impact grinding to progress up to 900 watts and above. This previously little known machining method takes on new importance in cutting and contouring extremely hard refractories and refractory metals such as boron carbide.

22423 **(LA-UR—81-1643) Ceramic heat exchangers: manufacturing techniques and performance.** Merrigan, M.A.; Sandstrom, D.J. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 16p. (CONF-810377—1). NTIS, PC A02/MF A01.

From WESTEC conference; Boulder, CO, USA (23 Mar 1981).

The objective of the ceramic heat pipe program being conducted at Los Alamos is demonstration of the practical feasibility of this technology for the solution of severe high temperature recuperation functions. Ceramic heat pipe recuperators have been theoretically shown to offer distinct advantages over conventional ceramic heat exchangers from the standpoint of efficiency of heat recuperation and economics. The main stumbling block to their widespread utilization is related to the problems of materials for construction and the details of fabrication and assembly. The performance objectives of ceramic heat pipes and some aspects of the materials technology program aimed at solving the problem of economic ceramic heat pipe fabrication are described.

22424 **(MLM—2826) Timer powder-pressing study.** Kaye, C.J.; North, C.J. (Mound Facility, Miamisburg, OH (USA)). 15 May 1981. Contract AC04-76DP00053. 28p. NTIS, PC A03/MF A01.

Several experiments were performed to evaluate the powder pressing techniques for the Pentaerythritol Tetranitrate (PETN) used in an explosive timer. Results from these investigations were then evaluated in relation to the product specifications and requirements to determine the optimal pressing procedure.

22425 **(PNL-SA—8797) Wire rope research and logging.** Morgenstern, M.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1981. Contract AC06-76RL01830. 8p. (CONF-810142—1). NTIS, PC A02/MF A01.

From 5. skyline logging symposium; Seattle, WA, USA (27 Jan 1981).

The various factors affecting the service life of wire ropes in skyline and dragline systems are discussed: design, geometry, sheave geometry, wear and lubrication, sheave hardness, pickup of small rocks, etc. (DLC)

22426 **(SAND—80-1987) Pulsed power for electromagnetic launching.** Cowan, M. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1980. Contract AC04-76DP00789. 27p. NTIS, PC A03/MF A01.

There are system advantages to producing power for electromagnetic propulsion by real-time generation rather than by a sequence of generation-storage-switching. The best type of generator for this purpose is the flux compression generator. Different types of flux compression generator which have been developed at Sandia National Laboratories are reviewed and their applications to electric launching are discussed. New experimental facilities for producing more powerful generators are described and cost comparisons are made.

22427 **(SAND—80-2549C) Utilization of hybrid computational equipment for the simulation of parachute system flight.** Curry, W.H.; Schatzle, P.R. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 24p. (CONF-810701—1). NTIS, PC A02/MF A01.

From Computer simulation conference; Washington, DC, USA (15 Jul 1981).

Hybrid (analog/digital) computational equipment has been satisfactorily utilized for flight simulation of parachute retarded configurations. Implementation of specific mathematical models on a hybrid computer is described, and example results are presented.

22428 **(UCID—19049) Optimizing the heat pipe for operation in a magnetic field when liquid-metal working fluids are used.** Werner, R.W.; Hoffman, M.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 May 1981. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01.

A novel method for reducing the magnetohydrodynamic (MHD) pressure drops in the liquid metal flow in a heat pipe wick is described. By flattening the heat pipe, the eddy current return path in the metallic heat pipe wall is inreased significantly, thereby increasing the effective wall resistance. This, in turn, reduces the magnitude of the MHD pressure drop. The same principle can also be applied to flows of liquid metal coolants in a magnetic field.

22429 **(UCRL—84875(Rev.1)) Results of railgun experiments powered by magnetic flux compression generators.** Hawke, R.S.; Brooks, A.L.; Deadrick, J.; Scudder, J.K.; Fowler, C.M.; Caird, R.S.; Peterson, D.R. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA)). 16 Mar 1981. Contract W-7405-ENG-48;W-7405-ENG-36. 14p. (CONF-801138—2(Rev.1)). NTIS, PC A02/MF A01.

From Electromagnetic guns and launchers conference; San Diego, CA, USA (4 Nov 1980).

Researchers from the Lawrence Livermore National Laboratory and the Los Alamos National Laboratory initiated a joint railgun research and development program to explore the potential of electromagnetic railguns to accelerate projectiles to hypervelocities. The effort was intended to (1) determine experimentally the limits of railgun operation; (2) verify calculations of railgun performance; and (3) establish a data base at megampere currents. The program has led to the selection of a particular magnetic flux compression generator (MFCG) design for a set of initial experiments and the design of small- and large-square-bore railguns to match the expected MFCG power profile. The bore sizes are 12.7 and 50 mm, respectively. In this paper, the design of the railguns and the diagnostic and data reduction techniques, followed by the results of eight experiments with the two railgun types, are presented.

22430 **(UCRL—84876(Rev.1)) Design and fabrication of large- and small-bore railguns.** Brooks, A.L.; Hawke, R.S.; Scudder, J.K.; Wozynski, C.D. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA)). 13 Mar 1981. Contract W-7405-ENG-48;W-7405-ENG-36. 16p. (CONF-801138—5(Rev.1)). NTIS, PC A02/MF A01.

From Electromagnetic guns and launchers conference; San Diego, CA, USA (4 Nov 1980).

A joint program between the Lawrence Livermore National Laboratory and the Los Alamos National Laboratory was conducted to establish whether railguns could be operated at megampere currents, to set operating limits, and to provide data to validate the modeling of railgun technology. The 12.7- and 50.0-mm-bore railguns designed and fabricated for this program are discussed. The design criteria, the materials and fabrication methods, and the success of the designs are discussed in detail.

22431 **(UCRL—84968) Angular measurements in optical testing.** Thomas, N.L. (Lawrence Livermore National Lab., CA (USA)). 25 Sep 1980. Contract W-7405-ENG-48. 7p. (CONF-800569—2). NTIS, PC A02/MF A01.

From Spring conference on applied optics; Oakland, CA, USA (31 May 1980).

The measurement of angles plays an important role in practically every discipline of optics, including prism manufacture, optical assembly and alignment. It is the purpose of this paper to review some of the angle measurement techniques and how they are used in optical testing.

22432 **(UCRL—85016) Energy flow in high speed perforation and cutting.** van Thiel, M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Oct 1980. Contract W-7405-ENG-48. 17p. (CONF-8010185—1). NTIS, PC A02/MF A01.

From 31. Aeroballistic Range Association conference; Pasadena, CA, USA (7 Oct 1980).

It is demonstrated that effects of long rod penetrators on targets can be modeled by introducing a high pressure (energy) column on the penetration path in place of the projectile. This energy can be obtained from the kinetic energy of the penetrator; the equations of state of the materials used and a Bernoulli penetration condition. The model is supported by detailed hydro calculations.

22433 **Magnetic drive vane pump (Mound drawing No. 18889 and 18890) (12 Mar 1981) (Engineering Materials).** (Mound Facility, Miamisburg, OH (USA)). (CAPE—2689).

2 drawings.

The magnetically coupled vane pump drive solves the critical problem of tritium leakage at the shaft seal of vane pumps. The

pump can develop a suction of 10 μm while pumping against a 50 psig head.

## 4203 Lasers

*REFER ALSO TO CITATION(S) 22914, 22916, 22966*

**22434 (LA-UR—81-1232) Small-signal-gain spectrum of an 1800 Torr $CO_2$ amplifier.** Goldstein, J.C.; Haglund, R.F. Jr.; Comly, J.C. Jr. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 12p. (CONF-810429—11). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

Prominent hot-band effects have been observed in the 9.4 and 10.6 μm gain spectrum of an 1800 Torr electron-beam-controlled-discharge $CO_2$ laser amplifier. The data are in good agreement with theoretical calculations at 53 different frequencies.

**22435 (LA-UR—81-1565) Ultraviolet phase conjugation and its practical implications.** Feldman, B.J.; Fisher, R.A.; Shapiro, S.L. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810429—23). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

We report the first demonstration of uv phase conjugation. Using a 15 psec, 2660 A pulse, 0.1% conjugate reflectivities were obtained via degenerate four-wave mixing in 1-mm samples of $CS_2$ mixtures. While pure $CS_2$ did not exhibit the effect, dilution in several uv transmitting solvents opened up a concentration-tunable (2450 A to 2850 A) spectral window, allowing the optical Kerr effect to be utilized. Weaker phase conjugation at 2660 A was also observed in other Kerr media and in saturable absorber media.

**22436 (LA-UR—81-1567) Laser damage testing of coated reflectors at excimer laser wavelengths.** Foltyn, S.R.; Newnam, B.E. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 11p. (CONF-810429—33). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

An important parameter in the design of large-scale ultraviolet lasers (such as those envisioned for Inertial Confinement Fusion and Molecular Laser Isotope Separation) is the resistance to optical damage of windows, AR-coatings, and coated reflectors. In addressing the problem of evaluating and optimizing highly reflective dielectric stacks, we have measured the damage thresholds of a variety of 248-nm, 308-nm, and 351-nm reflectors. The coatings were composed of quarterwave stacks of oxide and/or fluoride films deposited on Suprasil 2 substrates. Testing was accomplished at 35 Hz with nominal 10-ns pulses focused to a mean $1/e^2$ diameter of 0.5 to 0.6 mm. Damage threshold (defined as the highest fluence at which 10/10 sites survived 1000 shots) ranged from 1 to 5 $J/cm^2$, with a strong dependence upon laser wavelength and reflector coating materials.

**22437 Unidirectional, pulsed far-infrared ring laser.** Peebles, W.A.; Umstadter, D.; Brower, D.L.; Luhmann, N.C. Jr. (University of California, Los Angeles, California 90024). DE-AMO3-76-SF00010. *Applied Physics Letters ;* **38**: No. 11, 851-853(1 Jun 1981).

The first study of a pulsed, far-infrared, ring laser is described. Unidirectional, traveling-wave operation is observed, thereby eliminating the spatial hole burning effects present in linear cavities. Single-mode output powers of 100 kW have been obtained.

**22438 Analytic evaluation of interference effects on laser output in a Fabry-Perot resonator.** Agrawal, G.P.; Lax, M. (Department of Physics, City College of the City University of New York, New York, New York 10031). *Journal of the Optical Society of America ;* **71**: No. 5, 515-519(May 1981).

The effects of the forward- and backward-wave interference in a standing-wave resonator on laser output intensity are considered. In the paraxial- and plane-wave approximation and with boundary conditions appropriate for a Fabry-Perot resonator, the intensity equations are analytically solved. The variation of the output intensity with various parameters, such as the mirror reflection and absorption coefficients, small-signal gain, and atomic detuning, is considered, and the results are compared with those obtained when the interference effects are neglected. Considerable departure from the latter case is found. Our results should find application in choosing optimum parameters in the design of a laser resonator.

**22439 Photothermal deflection spectroscopy and detection.** Jackson, W.B.; Amer, N.M.; Boccara, A.C.; Fournier, D. (University of California, Lawrence Berkeley Laboratory, Applied Physics & Laser Spectroscopy Group, Berkeley, California 94720). *Applied Optics ;* **20**: No. 8, 1333-1344(15 Apr 1981).

The theory for a sensitive spectroscopy based on the photothermal deflection of a laser beam is developed. We consider cw and pulsed cases of both transverse and collinear photothermal deflection spectroscopy for solids, liquids, gases, and thin films. The predictions of the theory are experimentally verified, its implications for imaging and microscopy are given, and the sources of noise are analyzed. The sensitivity and versatility of photothermal deflection spectroscopy are compared with thermal lensing and photoacoustic spectroscopy.

**22440 Alternate model of CW dye laser intracavity absorption.** Brink, G.O. (State Univ. of New York at Buffalo, Amherst). Contract EG-77-S-02-4448. *Optics Communications ;* **32**: No. 1, 123-128(Jan 1980).

A new model is presented for intracavity absorption in a CW multimode dye laser based on the similarity between the laser and a self-quenched super-regenerative oscillator. The model suggests that the primary interaction mechanism between the atomic absorber and the laser is through a modification of the background radiation level from which the oscillation builds up. Numerical calculations are carried out leading to a prediction of the spectral line shape to be observed in intracavity absorption as well as the dependence of the signal on absorber density and pump power.

## 4204 Heat Transfer And Fluid Flow

*REFER ALSO TO CITATION(S) 22074, 22080, 22524*

**22441 (DOE/PC/30303—T2) Effect of solid particles on the turbulent flow of a round gaseous jet: a mathematical and experimental study. Quarterly technical progress report, January 1-April 30, 1981.** Elghobashi, S.E. (California Univ., Irvine (USA). Dept. of Mechanical Engineering). 11 May 1981. Contract FG22-80PC30303. 58p. NTIS, PC A04/MF A01.

This mathematical study aims at the development of a turbulence model which predicts the flow of a round turbulent gaseous jet lightly loaded with solid particles of uniform size. The derivation of the conservation equations of mass, momentum, kinetic energy of turbulence and the dissipation rate of that energy for a two-phase flow has been completed. The derivation started from the instantaneous Navier-Stokes equations. Two methods of time averaging the instantaneous equations were employed: the conventional Reynolds averaging and the density-weighted (or Favre) averaging. The latter is necessary in variable density flows, whereas the former is suitable for incompressible flows like the one considered in this project. The reason for using Favre averaging is to render the mathematical model (when completed) applicable to a wider range of two-phase flows, e.g., reacting or non-reacting. Progress in the modeling of the various turbulence correlations is described.

**22442 (EGG—1183-1800) Commentary on differential-pressure measurements at high reference pressures.** Hasbrouck, R.T.; Noyes, R.P. (EG and G, Inc., Las Vegas, NV (USA)). 1981. Contract AC08-76NV01183. 30p. (CONF-810637—2). NTIS, PC A03/MF A01.

From 11. transducer workshop; Seattle, WA, USA (2 Jun 1981).

Some practical approaches to the difficult problems in calibrating and implementing differential-pressure measurements are discussed. The data presented were gathered several years ago in separate investigations. An attempt is made to compare the results of these investigations to the common mode concept as described by Peter K. Stein in his publication, The Measurement of Differential Quantities - Problems and Approaches. Although one of these investigations invoked a 10,000- to 20,000-psi reference-pressure gas measured at an ambient temperature and the other a classic /sup Δ/P flow measurement of cryogenic temperature, the problems encountered were the same.

22443 **(UCRL—84691) Simulating interactions between turbulence and particles in erosive flow and transport.** Buckingham, A.C.; Siekhaus, W.J. (Lawrence Livermore National Lab., CA (USA)). 1981. Contract W-7405-ENG-48. 13p. (CONF-810702—2). NTIS, PC A02/MF A01.

From International conference on numerical methods for laminar and turbulent flow; Venice, Italy (13 Jul 1981).

A numerical procedure is described for simulating fluctuating gas motions and resulting forces on gas-borne particulates. Included are some of the particle influences which significantly alter the driving turbulent field. The coupling apparent between dispersed phase particles and continuous phase turbulent flow is introduced with the help of observations from complementary two-phase combustion wind tunnel experiments. In the simulations, particle-to-gas relative velocities and resulting forces on the particles are obtained at incremental time steps for statistically representative particle groups using a random selection method. The fluctuating velocity components are constrained so that their ensemble averages correspond to the pre-determined local mean turbulent energy. The influence of gas-borne particles on turbulent transport, combustion kinetics and subsequent wall surface erosion/corrosion is the central issue of this research.

22444 **(UCRL—85337) Solution of the time-dependent, three-dimensional incompressible Navier-Stokes equations via FEM.** Gresho, P.M.; Chan, S.T.K.; Lee, R.L.; Upson, C.D. (Lawrence Livermore National Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 14p. (CONF-810702—3). NTIS, PC A02/MF A01.

From International conference on numerical methods for laminar and turbulent flow; Venice, Italy (13 Jul 1981).

Simple techniques for solving the time-dependent, three-dimensional incompressible Navier-Stokes equations via the finite element method are described and involve (1) utilizing the trilinear 8-node isoparametric brick element for the velocity approximation (also for temperature and concentration where relevant) with piecewise-constant approximation of the pressure and (2) the time-integration technique which is basically the explicit forward Euler method, with the pressure obtained by solving the consistently derived Poisson equation. The advantages (speed and simplicity) and the disadvantages (stability limits on time-step size and the need to invoke mass lumping) of this technique are discussed and numerical examples presented.

22445 **(UCRL—85354) Solution of the time-dependent incompressible Navier-Stokes equations via a penalty Galerkin finite element method.** Sani, R.L.; Eaton, B.E.; Gresho, P.M.; Lee, R.L.; Chan, S.T. (Colorado Univ., Boulder (USA). Dept. of Chemical Engineering; Lawrence Livermore National Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 12p. (CONF-810702—1). NTIS, PC A02/MF A01.

From International conference on numerical methods for laminar and turbulent flow; Venice, Italy (13 Jul 1981).

The existence of an initial non-physical transient when using the penalty method in modeling the time-dependence incompressible Navier-Stokes equations is investigated theoretically and demonstrated numerically using the Galerkin finite element technique. A stable, variable step time integration scheme which can overlook the initial non-physical transient while using reasonable-sized time steps is described. Numerical examples illustrating the time integration scheme and concomitantly the difference in transient response of an incompressible fluid and its slightly compressible (penalty) analog are presented.

22446 **(UCRL—85366) Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems.** Gresho, P.M.; Lee, R.L.; Sani, R.L. (Colorado Univ., Boulder (USA). Dept. of Chemical Engineering; Lawrence Livermore National Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 14p. (CONF-810708—3). NTIS, PC A02/MF A01.

From 2. international conference on numerical methods in thermal problems; Venice, Italy (7 Jul 1981).

A consistent, accurate, and reasonably simple method of obtaining derived quantities when the conventional Galerkin Finite Element Method (GFEM) is used to obtain the primary quantities is defined and demonstrated, both theoretically and numerically.

22447 **Infrared techniques for the evaluation of silicon carbide heat-exchanger tubing.** Deininger, W.D.; Kupperman, D.S. (Argonne National Lab., IL). Contract W-31-109-ENG-38. *Journal of Testing and Evaluation ;* **8**: No. 1, 48-54(1980).

The potential application of infrared techniques to detect flaws and measure heat transport in silicon carbide heat-exchanger tubing is discussed. Axial heat-flow patterns were monitored with a commercially available infrared camera. Computer modeling was used to help establish the relationship between temperature distributions and the various thermal parameters. The experimental data and computer-modeling predictions were in fair agreement. These tests indicated that thermography may be a useful nondestructive-evaluation technique for rapid assessment of thermal-heat-transport properties in silicon carbide heat-exchanger tubing.

## 4205 Materials Testing

*REFER ALSO TO CITATION(S) 22447*

22448 **(UCRL—85254) Reliability studies of materials using several LSI-11 based systems.** Gertz, K.A. (Lawrence Livermore National Lab., CA (USA)). 2 Apr 1981. Contract W-7405-ENG-48. 5p. (CONF-810546—1). NTIS, PC A02/MF A01.

From 1981 spring DECUS U.S. symposium; Miami Beach, FL, USA (18 May 1981).

Valid predictions about the reliability of materials require tests on a large number of samples. The materials must undergo a number of different types of load histories in order to make an accurate definition of the damage function. At LLNL, a test facility was designed that allows material testing of strength and life to be done at the different load histories. The facility uses several LSI-11 microcomputers as multichannel data acquisition systems. Currently, each system operates independently using floppy disks as program and data storage. The floppy disks containing the data are hand carried to a PDP-11/60 minicomputer for data analysis. Each system uses an analog-to-digital (A/D) converter selected to best fit the characteristics of the signal being measured; i.e., a high-speed direct memory access (DMA) A/D for signals with fast rise times, an integrating A/D for signals with an ac component, etc. How the Mechanics of Materials Test Facility is implemented is described.

## 4206 Safety Engineering

*REFER ALSO TO CITATION(S) 21505, 21561*

## 4207 Vacuum Engineering

22449 **Nitrogen sensitivities of a sample of commercial hot cathode ionization gage tubes.** McCulloh, K.E.; Tilford, C.R. (Center for Absolute Physical Quantities, National Bureau of Standards, Washington, D.C. 20234). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 994-996(Apr 1981).

In order to help assess the magnitude of errors that might arise from the use of uncalibrated ionization gage tubes and help select the best type of tube when accurate measurements are required we have determined the nitrogen sensitivities from $10^{-5}$ to $10^{-2}$ Pa for lots of from two to four each of five different types of

commerical hot cathode gage tubes. Included were conventional triodes and B-A structures of four distinct types. Two types with tungsten filaments: the triodes and tubulated B-A structures: were markedly superior to the others with respect to agreement with manufacturer's sensitivity, linearity, and uniformity of sensitivity within a type. The least satisfactory results were obtained from the nude B-A structures, which showed significant nonlinearities, sensitivities ranging from 70%—110% of the manufacturer's value, and typical 25% differences in sensitivity between the two filaments of a dual-filament structure.

22450 **Selection and evaluation of an ultrahigh vacuum gate valve for ISABELLE beam line vacuum system.** Foerster, C.L.; McCafferty, D. (Accelerator Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 997-1000(Apr 1981).

A minimum of 84 ultrahigh vacuum gate valves will be utilized in ISABELLE to protect proton beam lines from catastrophic vacuum failure and to provide sector isolation for maintenance requirements. The valve to be selected must function at less than 1 x $10^{-11}$ Torr (1.3 x $10^{-9}$ Pa) and be bakeable to 300 °C in its open or closed position. In the open position, the valve must have an rf shield to make the beam line walls appear continuous. Several proposed designs were built and evaluated. The evaluation consisted mainly of leak testing, life tests, thermal cycling, mass spectrometer analysis, and $10^{-12}$ Torr operation. Problems with initial design and fabrication were resolved. Special requirements for design and construction were developed. This paper describes the tests on two final prototypes which appear to be the best candidates for ISABELLE operation.

22451 **Water vapor pressure gauge.** Edwards, D. Jr.; Gillette, D. (Brookhaven National Laboratory, Upton, New York 11973). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1023-1025(Apr 1981).

An inexpensive pressure gauge, able to measure the $N_2$ and $H_2O$ components within a vacuum system in the pressure range 1 to 400 m is described and results of tests of the device are reported.

22452 **Performance of BNL-TSTA compound cryopump.** Hseuh, H.C.; Worwetz, H.A. (Accelerator Department, Brookhaven National Laboratory, Upton, New York 11973). DE-ACOZ-76 CH00016. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1131-1135(Apr 1981).

The Tritium Systems Test Assembly Vacuum Facility at Los Alamos Scientific Laboratory is intended to demonstrate realistic fuel supply and cleanup operations similar to those anticipated on fusion devices. The plasma exhaust gases are expected to be mixtures of helium and hydrogen isotopes which can be pumped most efficiently by cryopumping. A compound cryopump for on-line operation at TSTA using cryocondensation for hydrogen isotopes and cryosorption for helium has been designed by BNL and fabricated by Janis Research. The details of this compound cryopump are described in this paper. The performance of the pump during the predelivery testing at BNL, such as the heat load during operation and the pumping speed and pump capacity for helium and hydrogen, are also discussed in detail.

22453 **Pumping behavior of sputter ion pumps.** Chou, T.S.; McCafferty, D. (Accelerator Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1148-1151(Apr 1981).

The ultrahigh vacuum requirements of ISABELLE are obtained by pumping stations, each consisting of a 1000 l/s titanium sublimation pump for active gases ($N_2$, $H_2$, $O_2$, CO, etc.), and a 20 l/s sputter ion pump for inert gases (methane, noble gases like He, etc.). The combination of the alarming production rate of methane from titanium sublimation pumps (TSP) and the decreasing pumping speed of sputter ion pumps (SIP) in the ultrahigh vacuum region (UHV) leads us to investigate this problem. In this paper, we first describe the essential physics and chemistry of the SIP in a very clean condition, followed by a discussion of our measuring techniques. Finally, we present our measured methane, argon, and helium pumping speeds for three different ion pumps in the range of $10^{-6}$ to $10^{-11}$ Torr. The virtues of the best pump are also discussed.

22454 **Steam ejector-condenser: stage I of a differential vacuum pumping station.** Hanson, C.L.; Alger, T.W. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). W-7405-ENG-48. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1164-1168(Apr 1981).

A steam ejector-condenser unit was built and tested to produce a 10 Torr (13.3 x $10^2$Pa) vacuum with a 2 cm aperture to the atmosphere. This unit is the first stage of a differential vacuum pumping station that will be used with the Experimental Test Accelerator. The accelerator's electron beam will pass through a series of openings from a high vacuum (5 x $10^{-6}$ Torr) to the atmosphere. The differential system consists of four vacuum pumping units separated by 2 cm-diam apertures. Superheated steam is injected near the final beamline orifice to reduce the quantity of atmospheric air flowing into the steam ejector—condenser unit. The steam ejector in the condenser vessel is open at its center to permit passage of the accelerator beam. Five nozzles mounted in a conical array produce the ejector vacuum of 10 Torr. The ejector exhausts into the condenser and forms a barrier to air flow into the lower pressure region. This feature permits high volume cold trapping and cryopumping of water vapor in the remaining lower-pressure stages. Tests have proven that the steam ejector—condenser is a reliable operating unit and suitable for long-term, steady-state accelerator operation.

22455 **Interrupted pumpdown of a vacuum system.** Edwards, D. Jr. (Brookhaven National Laboratory, Upton, New York 11973). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1169-1170(Apr 1981).

The pressure rise due to a surface outgassing process following a real pump closure has been analyzed and found under a physically reasonable parameter selection to occur very quickly yet result in a very slight actual pressure change. Real leaks thus should be able to be distinguished from surface outgassing processes by this technique.

## 4208 Electronic Circuits And Devices

*REFER ALSO TO CITATION(S) 22530*

22456 **(SAND—81-0658C) Discussion of the role of distributed effects in latch-up.** Ochoa, A. Jr.; Dressendorfer, P.V. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 7p. (CONF-810707—1). NTIS, PC A02/MF A01.

From IEEE conference on nuclear science and space radiation; Seattle, WA, USA (21 Jul 1981).

Latch-up in monolithic integrated circuits, the activation of parasitic four-layer paths capable of regeneration, has long posed a significant reliability problem, especially to the radiation effects community. While methods for the prevention of latch-up have been proposed and implemented, the question of elimination remains at best uneasily answered in the advent of reduced geometries. This seems to be due to a lack of a fundamental understanding of the SCR phenomena in parasitic structures, as proposed solutions have generally been based on a classical analysis or on intuition. Certain distributed and parasitic aspects of four-layer structures that play significant roles in latch-up, i.e., contact and spreading resistance effects and the selection of proper lumped model parameters for the discrete cross-coupled bipolar model, are discussed. The distributed effects of contact resistance and spreading resistance and the drive conditions of the coupled transistor pair are shown to be of particular importance in applying the lumped model theory to parasitic latch-up phenomena and in understanding parasitic latch-up. The lumped model will continue to be a useful conceptualization and analysis vehicle but must allow for additional parasitic elements, and coupled shunt paths must be considered. Possible changes in device parameters reflecting the distributed nature of the devices with changes in modes of operation of the latch-up path should be taken into account.

22457 **(UCRL—83992) Subnanosecond trigger system for ETA.** Cook, E.G.; Lauer, E.J.; Reginato, L.L.; Rogers D.; Schmidt, J.A. (Lawrence Livermore National Lab., CA (USA)). 30 May 1980. Contract W-7405-ENG-48. 16p. (CONF-800640—20). NTIS, PC A02/MF A01.

From 14. pulse power modulator symposium; Orlando, FL, USA (3 Jun 1980).

A high-voltage trigger system capable of triggering 30, 250 kV spark gaps; each with less than +- 1 ns jitter has been constructed. In addition to low jitter rates, the trigger system must be capable of delivering the high voltage pulses to the spark gaps either simultaneously or sequentially as determined by other system requirements. The trigger system consists of several stages of pulse amplification culminating in 160 kV pulses having 30 ns risetime. The trigger system is described and test data provided.

22458 **Exposure and development models used in electron beam lithography.** Hawryluk, R.J. (Princeton University, Plasma Physics Laboratory, P. O. Box 451, Princeton, New Jersey 08544). DE-AC02-76-CH0-3073. *Journal of Vacuum Science and Technology, The ;* **19**: No. 1, 1-17(May 1981).

This review examines exposure and development models which are used in electron beam lithography to predict resist profiles. The following topics are discussed: development models of positive polymeric electron resists, in particular, poly-methyl-methacrylate; exposure models based on analytic or Monte Carlo calculations of energy dissipation; comparisons of experimental measurements of linewidth and profile shape and predictions based upon exposure and development models; the dependence of proximity effects on resist and substrate thickness, beam voltage, and substrate material; and finally algorithms used to alter the exposure or pattern shape or both to compensate for proximity effects. The understanding which is gained from the exposure and development models is discussed in terms of fabrication techniques used in electron beam lithography.

## 4209 Waste Processing Plants And Equipment

*REFER ALSO TO CITATION(S) 22238*

## 4210 Combustion Systems

*REFER ALSO TO CITATION(S) 21992, 22000, 22240*

22459 **(DOE/ET/10484—T2) Multi-stage desulfurizing fluid-bed combustor for coal-fired hot gas generator systems: Topical report No. 3, Task 6. Modifications to Materials Handling Equipment. Task 7. Testing.** Lowell, C. (Wormser Engineering, Inc., Middleton, MA (USA)). Apr 1981. Contract AC21-78ET10484. 91p. NTIS, PC A05/MF A01.

This report covers the modification of Materials Handling Equipment, Testing and Program Management of Tasks 6, 7 and 8 of Phase 2. The Cohogg system contains a pyrolyzer for partial gasification of the coal through sub-stoichiometric combustion, a char burner which burns the char (generated in the pyrolyzer) in excess air, and an afterburner where the pyrolyzer gases and the char burner gases mix to produce a high temperature (~ 3000°F) environmentally clean flame capable of replacing an oil or gas burner. The system has operated successfully and demonstrated the capability of producing an environmentally clean high temperature flame. Operation with 15% excess air overall demonstrated a 3200°F capability while sulfur retention was in excess of 90%. After more than 100 hours of operation the system shows itself to have flexibility in coal type, sorbent type, and operating temperatures while maintaining a clean high temperature flame and meeting or exceeding current pollution restrictions.

22460 **(DOE/MC/16230—154) Rivesville multicell fluidized-bed boiler. Annual technical progress report, July 1979-June 1980.** (Pope, Evans and Robbins, Inc., New York (USA)). 1980. Contract AC21-81MC16230. 133p. NTIS, PC A07/MF A01.

Design, construction and test program of a 300,000 lb/hr steam generating capacity multicell fluidized bed bouler (MFB), as a pollution free method of burning high-sulfur or highly corrosive coals, is being carried out. The concept involves burning fuels such as coal, in a fluidized bed of limestone particles that react with the sulfur compounds formed during combustion to reduce air pollution. Nitrogen oxide emissions are also reduced at the lower combustion temperatures. The $CaSO_4$ produced in the furnace is discharged with the ash or regenerated to CaO for reuse in the fluidized bed. This report presents information on continued operation of the Rivesville MFB steam generating plant in a commercial mode and for determining performance and emission characteristics; studies and tests on flyash characterization and reinjection, fuel feed educators and needles, air distributor, corrosion-erosion and sulfur capture; engineering studies to improve MFB performance and reliability.

22461 **(EPRI-P—1726-SR, pp 13-90) Coal Combustion Systems Division.** Jan 1981. NTIS, PC A21/MF A01.

In 1981-1985 research and development program plan: program descriptions.

The EPRI Coal Combustion Systems Division focuses its research and development efforts on problems of near-term importance to the electric utility industry. Priority is placed on achieving effective and rapid (one- to five-year) solutions to interrelated issues in plant reliability, environmental control, fuel quality, combustion hardware, and plant performance associated with fossil fuels. Resolution of these issues will mean survival for many utilities. Three R and D goals will help structure and guide the research: (1) maintain the viability and improve the performance of conventional fossil-fuel generating systems; (2) develop advanced coal-based generating systems; and (3) develop technology for producing storable clean fuels from domestic resources. Program objectives, budgets, and relationships of these goals are developed. 24 figures.

22462 **State of fluidized bed combustion technology.** Pope, M. (Pope, Evans and Robbins, Inc, USA). pp vp of Annual international conference on coal gasification, liquefaction, and conversion to electricity, 55th, 1978. Pittsburgh, PA; Univ. of Pittsburgh (Aug 1978).

From 5. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (1 Aug 1978).

Low quality fuels can be burned directly in fluidized-beds while taking advantage of low furnace temperatures and chemical activity within the bed to limit $SO_2$ and NO/sub x/ emissions. The excellent heat transfer characteristics result in a reduction of total heat transfer surface requirements. Tests on beds operating at pressures of one to ten atmospheres, at temperatures as high as 1600°F, and with gas velocities in the vicinity of four to twelve feet per second, have proven the concept. 7 refs.

## 4220 Underground Engineering

22463 **(UCID—18286) Size distribution of LLNL coarse fill.** Griffiths, S.K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 May 1981. Contract W-7405-ENG-48. 25p. NTIS, PC A02/MF A01.

The distributions of particle size in the coarse fill used by Lawrence Livermore Laboratory (LLL) were investigated. The relative frequency and cumulative distributions by mass were expressed as truncated lognormal distributions. Nominal particle diameter was found as a linear function of particle size. On the basis of this relation and the distributions by mass, the frequency and cumulative distributions by count were determined. This information may aid in understanding stemming phenomena such as slumps, cable and pipe loading, and cable damage.

## 4240 Pollution Control Equipment

*REFER ALSO TO CITATION(S) 21540, 22462*

22464 (ANL/EES-TM—130, pp 51-65) **Regional and national $SO_2$ control costs.** Oct 1980. NTIS, PC A05/MF A01.

In Air quality analysis of Phase I of the proposed oil backout legislation.

In this section, estimates are made of the $SO_2$ control costs that would be incurred by utilities in complying with the $SO_2$ emis-

sions limitations detailed in Sec. 2. The aim of this part of the analysis is to determine which control strategies are most cost-effective in reducing $SO_2$ emissions.

**22465 (LBL—12215) Characterization of the selective reduction of NO by $NH_3$.** Lucas, D.; Brown, N.J. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 56p. (CONF-810466—3). NTIS, PC A04/MF A01.

From Spring meeting of the Western States Section of the Combustion Institute; Pullman, WA, USA (13 Apr 1981).

The selective reduction of NO by $NH_3$ addition has been studied in a lean-burning oil-fired laboratory combustion tunnel as a function of equivalence ratio, $NH_3$ injection temperature, concentration of $NH_3$ added, and the source of NO. Ammonia breakthrough was found to depend strongly on the $NH_3$ addition temperature. The total concentration of nitrogen containing species other $N_2$, NO, and $NH_3$ was measured with a variety of techniques and was found to be less than 5 ppM over the range of conditions studied.

# 43 PARTICLE ACCELERATORS

## 4302 Beam Dynamics, Field Calculations, And Ion Optics

**22466 (DOE/ER/01388—488) Investigation of periodic acceleration tube discharges with a capacitive pickup array.** Trainor, T.A. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1981. Contract AC06-76ER01388. 3p. (CONF-810468—4). NTIS, PC A02/MF A01.

From 3. international conference on electrostatic accelerator technology; Oak Ridge, TN, USA (13 Apr 1981).

Several diagnostic techniques are described, which were used to determine the cause of periodic tube discharges and consequent fast terminal voltage drops in an FN tandom accelerator which were observed to occur at high beam intensities for the voltage range 7 to 9 MV. Terminal voltage drops were first monitored with a generating voltmeter (GVM). As a result of this study it was decided to install an array of four capacitive pickups (mushrooms) along the length of the pressure vessel. Information obtained from these pickups and analysis of beam fluctuation data permitted the source of the difficulty to be identified as a high transmission grid installed at the entrance to acceleration tube 1.

**22467 (DOE/ER/05940—2) Study of instabilities and emittance growth in periodic focusing systems for intense beams. Progress report, Technical report No. PP 81-198.** Reiser, M. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). May 1981. Contract AS05-78ER05940. 22p. NTIS, PC A02/MF A01.

Initial problems with secondary electrons and diagnostics were solved. Beam expansion in free space and focusing by one and two solenoid lenses were studied in the experiment. Of particular interest are the special effects (beam explosion, images) caused by electrons scattered at the anode mesh.

**22468 (LBL—11580) Automatic tuning of the LBL Bevalac transfer line.** Pines, H.; Selph, F. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 4p. (CONF-810314—141). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Automatic tuning of a beam transport line has been accomplished successfully with the Bevalac control computer. Both steering and focusing corrections are made. New magnet currents are computed from equations governing beam optics in a real-time simulation of the beam line. This approach requires iteration although it converges quite rapidly. Computer automatic tuning is comparable to the most time efficient manual tuning operation.

**22469 (LBL—11726) Metallic wedge degraders for rapid energy measurement of Bevalac heavy ion beams.** Wada, R.; Alonso, J.R. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 4p. (CONF-810314—143). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

An ever-present need in an accelerator-based research program is knowing the energy of the beam delivered to the experimenter. Knowledge of accelerator parameters is generally good enough to predict the beam energy to within a few percent as it leaves the machine, but after passage through a complex switchyard, with air gaps, and non-destructive monitors, substantial changes in the energy can occur. Knowledge of the material in the beam path allows for calculations of expected energy loss, but this knowledge is not always complete, and the unforeseen often plays tricks on the unwary experimenter; for example, a section of beampipe inadvertently let up to air, or a monitor left in the beam-line from the previous run. Although such occurrences are rare, to say they do not happen would be grossly inaccurate. The only defense of the experimenter, then, is to have an accurate technique for determining the beam energy at his target location, a technique which requires little beam time and which is non-disruptive of his experimental setup. The device described meets all of these criteria, and is now used extensively in the Nuclear Science and Biomedical programs at the Bevalac.

**22470 (SLAC-PUB—2666) Some schemes for on-line correction of the closed orbit, dispersion and beta functions in PEP.** Donald, M.H.R.; Blocker, C.; Chao, A.W.; Hollebeek, R.J.; Lee, M.J.; Linstadt, J.E.; Siegrist, J.L.; Spencer, N. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—154). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

PEP has been operated successfully under computer control. It is necessary for colliding beam operation that the errors in closed orbits, dispersion and beta functions be corrected. The schemes in the PEP control program for on-line correction of these errors are described in this paper. The orbit control tasks in the PEP control system perform the functions of data gathering, data presentation (color display, printing), calculation and setting of corrector magnets. The tasks are generally small and modular, taking information from the database, processing it, then returning the results to the database. The PEP operator communicates with the tasks through touch panels monitored by the Director program. The display task, which displays orbit and corrector information on a TV color display, provides the main information required by the operator.

**22471 (SLAC-PUB—2670) Operation of PEP longitudinal feedback system.** Allen, M.A.; Karvonen, L.G.; McConnell, R.A.; Schwarz, H. (Stanford Linear Accelerator Center, CA (USA)). Mar 1981. Contract AC03-76SF00515. 3p. (CONF-810314—155; PEP-NOTE—351). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

In order to suppress longitudinal coupled-bunch oscillations which might limit the capabilities of PEP, the 18 GeV $e^+e^-$ storage ring at SLAC, a longitudinal feedback system is utilized. A frequency domain feedback system was chosen with the frequency spectrum of the stored beam being sampled close to a symmetry point in the ring where the feedback cavity itself is also located. The symmetry point chosen is symmetry point 5 which lies half-way between interaction regions 4 and 6. The system has been installed in PEP and is now operational. However, at stored currents up to the maximum stored in PEP to date at 14.5 GeV (approximately 40 mA in 6 bunches), the ring has been stable to all modes of longitudinal coupled-bunch oscillations both barycentric and the other fundamental modes. By deliberately detuning the main accelerating cavities, small multibunch oscillations can be introduced which, in turn, can be damped by the feedback system. Under optimized beam conditions the feedback system could be adjusted to positive feedback and excite oscillations with relatively small power to the feedback cavity. This will be described along with other details of the system.

**22472 (SLAC-PUB—2672) Mathematical models for the control program of the SLAC linear collider.** Lee, M.J.; Blocker, C.; Chao, A.W. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—156). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The operation of the SLAC two-mile linear accelerator in the single pass collider mode will be computer controlled. Mathematical models will be used in the control program to set up and restore the beam optics and to correct orbits. Some of the requirements imposed upon the on-line model calculations and the ways to satisfy these requirements will be described in this paper.

**22473 (SLAC-PUB—2673) Numerical simulation of the transport of intense beams of heavy ions in an electrostatic quadrupole system.** Close, E.; Herrmannsfeldt, W.B. (Lawrence Berkeley Lab., CA (USA); Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—144). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A computer program which models the behavior of an intense beam of charged particles in a periodic focusing system is described. The program solves for electrostatic fields in two dimensions, i.e., the x-y coordinates of a typical electrostatic quadrupole lens, including the space-charge fields due to the presence of an array of macroparticles. Adjacent drift sections and quadrupoles are defined by hard edges, i.e., no fringing fields. However, longitudinal changes in electrostatic potential are used to calculate applied axial fields. Particles are tracked through short segments for which Poisson's equation is solved to update the self-fields. Examples shown include the transport of an intense (space charge limited) beam in a periodic structure and the optics of a matching system between ion source and transport system. The program is equally applicable to magnetic or electrostatic focusing. In either case it accounts for space-charge image field effects which are frequently ignored in other treatments of this problem.

**22474 (SLAC-PUB—2678) Non-linear optics for the final focus of the single-pass-collider.** Brown, K.L.; Spencer, J.E. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (PEP-NOTE—345; CONF-810314—152). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The purpose of the final focus system (FFS) is to demagnify the beam envelope in the Collider arc lattice to a size suitable for beam collisions at the interaction region. The final spot size is determined by the beam emittance, the beta function $\beta^*$ at the IR, the momentum spread in the beam, and the quality of the FFS optics. In particular, if the focusing system is not chromatically corrected, the momentum dispersion in the beam can lead to a substantial degradation in the quality of the final focus. The objective is to design a FFS for 50 GeV/c within $\sim$ 100 meters having an IR spot size $\sigma$/sub xy/ of approximately 2 $\mu$m for a beam emittance of $\epsilon = 3 \times 10^{-10}$ m-rad and a momentum spread of $\delta = +$-0.5%. This requires a $\beta$/sub x,y/ equal to or less than 1 cm. This report considers the problems encountered in the design of a final focus system that will reliably provide the desired beam size for collisions.

**22475 (SLAC-PUB—2683) Optical beam diagnostics on PEP.** Sabersky, A.P. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—145; PEP-NOTE—349). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

In designing the PEP optical diagnostics we have been able to build on the experience gained with SPEAR. Most of the problems at SPEAR could be traced to the optical diagnostic system being inside the tunnel. A machine shutdown is required for any maintenance or modification. This implies that in order to make such an instrument successful, a large engineering effort must be mounted to ensure 100% operation at startup. The functions that do not work at startup may never be made to work; this has happened at several machines. Experimental setups are likewise risky and time consuming. A point which has been borne out in both SPEAR and PEP is that the mechanical part of the instrument, the special vacuum chamber, the optical mounts, the alignment and adjustments, require approximately 60% of the effort and cost of the optical diagnostics. It is far better to economize on detectors and electronics than on mechanical and optical essentials.

**22476 (SLAC-PUB—2688) Computer simulation of longitudinal single-bunch effects in electron-positron storage rings.** Wilson, P.B.; Bane, K.L.F.; Satoh, K. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—139; PEP-NOTE—355). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The computer code TRACK simulates longitudinal single-bunch effects in an electron-positron storage ring. The program tracks the turn-by-turn energy and phase deviations of N superparticles, where N is 100-1000. In addition to the usual RF and lattice parameters, an input to the program is the wake potential function for the ring vacuum chamber. The program has been applied to compute bunch lengthening in SPEAR as a function of charge per bunch. Although the computed results are in qualitative agreement with measurements, there are discrepancies in some details. Possible reasons for these discrepancies are discussed.

**22477 (SLAC-PUB—2690) Operation of the PEP transverse beam feedback.** Olson, C.W.; Paterson, J.M.; Pellegrin, J.L.; Rees, J.R. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—153; PEP-NOTE—348). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The PEP Storage Ring has been equipped with a wide band beam feedback system capable of damping the vertical and horizontal motion of six bunches. The oscillation detection is done at a symmetry point on the Storage Ring and feedback is applied at the same location one orbital period later. The signal is synchronously gated and the system appears as twelve independent feedback loops, operating on the two coordinates of each of the six bunches. Two beam deflection electrodes are driven each by a low-Q push-pull amplifier which is tuned at the 72nd harmonic of the revolution frequency and suppressed-carrier modulation is generated by a sequence of the detected bunch oscillations. The design parameters are reviewed as well as the salient features of the hardware, and the impact of this system on the machine operation is evaluated in the light of experimental results.

**22478 (SLAC-PUB—2700) Experimental observations and theoretical models for beam-beam phenomena.** Kheifets, S. (Stanford Linear Accelerator Center, CA (USA)). Mar 1981. Contract AC03-76SF00515. 89p. NTIS, PC A05/MF A01.

The beam-beam interaction in storage rings exhibits all the characteristics of nonintegrable dynamical systems. Here one finds all kinds of resonances, closed orbits, stable and unstable fixed points, stochastic layers, chaotic behavior, diffusion, etc. The storage ring itself being an expensive device nevertheless while constructed and put into operation presents a good opportunity of experimentally studying the long-time behavior of both conservative (proton machines) and nonconservative (electron machines) dynamical systems - the number of bunch-bunch interactions routinely reaches values of $10^{10}$-$10^{11}$ and could be increased by decreasing the beam current. At the same time the beam-beam interaction puts practical limits for the yield of the storage ring. This phenomenon not only determines the design value of main storage ring parameters (luminosity, space charge parameters, beam current), but also in fact prevents many of the existing storage rings from achieving design parameters. Hence, the problem has great practical importance along with its enormous theoretical interest. A brief overview of the problem is presented.

**22479 Characterization and suppression of zero-frequency cyclotron waves on relativistic electron beams.** Shanahan, W.R. (Intense Charged Particle Beam Theory Group, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Physics of Fluids ;* **24**: No. 6, 1195-1206(Jun 1981).

Zero-frequency cyclotron waves, which can be excited by a variety of static perturbations, produce large-scale disruption of relativistic electron beam equilibria. A study of their basic nonlinear properties and an examination of methods with which to achieve their effective suppression are presented. A simple set of envelope equations based on the signal-particle equations of motion is derived. Both analytic and numerical solutions are obtained for the case of a uniform magnetic guide field. The envelope equations are then used to investigate methods of suppression. It is found that although a spatially steeply rising magnetic field is a key component in achieving such suppression, initial beam momentum flaring plays a crucial role. Relativistic, fully electromagnetic particle-in-cell simulations designed to examine methods of suppression are presented.

**22480 (LA-tr—80-10) Particle dynamics in linear resonance accelerators.** Kapchinskii, I.M. (Los Alamos Scientific Lab., NM (USA)). 1980. Translation of Dinamika chastits v lineinykh rezonansnykh uskoriteliakh; Atomizdat, Moscow, USSR, 1966. 386p. NTIS, PC A17/MF A01.

Topics covered include: longitudinal particle oscillation in beams with negligibly low space-charge density; transverse particle oscillation in beams with negligibly low space-charge density; transverse particle oscillations in beams with high space charge density; and longitudinal oscillations of particles in beams with high space-charge density. (GHT)

## 4303 Auxiliaries And Components

*REFER ALSO TO CITATION(S) 22470, 22472, 22514, 22787, 22809, 22844*

**22481 (BNL—29243) RELWAY: a process data highway system optimized for accelerators.** Frankel, R.; Buxton, W.; Kohler, K.; Warkentien, R.; White, A. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 3p. (CONF-810314—62). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The command/control scheme for the Isabelle accelerator, specifically the process data highway are discussed. (GHT)J

**22482 (DOE/ER/01388—489) Improved two-loop beam energy stabilizer for an FN tandem accelerator.** Trainor, T.A. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1981. Contract AC06-76ER01388. 4p. (CONF-810468—2). NTIS, PC A02/MF A01.

From 3. international conference on electrostatic accelerator technology; Oak Ridge, TN, USA (13 Apr 1981).

A detailed analysis of the properties of various elements in a two-loop voltage regulator for a tandem accelerator enabled design of an optimum system which reduces effective accelerating voltage noise below 100 V. Essential features of the new system are high-quality slit preamplifiers, careful attention to removal of extraneous noise sources, and proper shaping of frequency responses to maximize stable gains and ensure compatibility of the two control loops. The resultant beam energy stabilizer system is easy to operate, has well defined indicators for proper adjustment of operating parameters, and recovers reliably from beam interruptions.

**22483 (DOE/ER/03072—1) Toroidal magnetic detector.** Pope, B.G. (Princeton Univ., NJ (USA). Joseph Henry Labs.). 1981. Contract AC02-76ER03072. 9p. (CONF-810474—1). NTIS, PC A02/MF A01.

From Workshop for experiments as 50x50 GeV; Ithaca, NY, USA (Apr 1981).

Properties of the superconducting toroidal magnet for the detector at ISABELLE are discussed, along with ways it could be used to make significant physics contributions at a high energy $e^+e^-$ storage ring. (GHT)

**22484 (DOE/ER/05911—T1) Design study for a high-current, steady-state auto-resonant accelerator. Addendum to final report, July 14, 1979-November 14, 1979.** Drummond, W.E. (Austin Research Associates, Inc., TX (USA)). 1979. Contract AC05-78ER05911. 60p. (COO—5911-5). NTIS, PC A04/MF A01.

A number of potential applications for the auto-resonant accelerator (ARA) are discussed. The potential uses are divided into two categories: the use of the ARA in energy or fuel production cycles which would gave significant energy policy ramifications, and miscellaneous research, medical and industrial use of the ARA which may be attractive. The output parameters, cost and size data are summarized to provide a basis for judging potential uses. The use of ARA for the production of fissile material is discussed, as is its use as a plasma heating device for tokamak experiments or potential fusion reactors.

**22485 (LA-UR—81-1324) Torus sector handling system.** Grisham, D.L. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810366—1). NTIS, PC A02/MF A01.

From Remote maintenance equipment workshop; Oak Ridge, TN, USA (12 Mar 1981).

A remote handling system is proposed for moving a torus sector of the accelerator from under the cryostat to a point where it can be handled by a crane and for the reverse process for a new sector. Equipment recommendations are presented, as well as possible alignment schemes. Some general comments about future remote-handling methods and the present capabilities of existing systems will also be included. The specific task to be addressed is the removal and replacement of a 425 to 450 ton torus sector. This requires a horizontal movement of ~ 10 m from a normal operating position to a point where its further transport can be accomplished by more conventional means (crane or floor transporter). The same horizontal movement is required for reinstallation, but a positional tolerance of 2 cm is required to allow reasonable fit-up for the vacuum seal from the radial frames to the torus sector. Since the sectors are not only heavy but rather tall and narrow, the transport system must provide a safe, stable, and repeatable method fo sector movement. This limited study indicates that the LAMPF-based method of transporting torus sectors offers a proven method of moving heavy items. In addition, the present state of the art in remote equipment is adequate for FED maintenance.

**22486 (LA-UR—81-1640) Application of parallel preprocessors in data acquisition.** Butler, H.S.; Cooper, M.D.; Williams, R.A.; Hughes, E.B.; Rolfe, J.R.; Wilson, S.L.; Zeman . (Los Alamos Scientific Lab., NM (USA); Stanford Univ., CA (USA). W.W. Hansen Labs. of Physics). 1981. Contract W-7405-ENG-36. 8p. (CONF-810523—6). NTIS, PC A02/MF A01.

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

A data-acquisition system is being developed for a large-scale experiment at LAMPF. It will make use of four microprocessors running in parallel to acquire and preprocess data from 432 photomultiplier tubes (PMT) attached to 396 NaI crystals. The microprocessors are LSI-11/23s operating through CAMAC Auxiliary Crate Controllers (ACC). Data acquired by the microprocessors will be collected through a programmable Branch Driver (MBD) which also will read data from 52 scintillators (88 PMTs) and 728 wires comprising a drift chamber. The MBD will transfer data from each event into a PDP-11/44 for further processing and taping. The microprocessors will perform the secondary function of monitoring the calibration of the NaI PMTs. A special trigger circuit allows the system to stack data from a second event while the first is still being processed. Major components of the system were tested in April 1981. Timing measurements from this test are reported.

**22487 (LBL—11709) Use of a small off-line computer in the operation of a versatile heavy ion cyclotron.** Gough, R.A. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 6p. (CONF-810314—158). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

In a modern heavy ion cyclotron with variable energy and particle species, it is essential to provide the operations staff with fast and easy access to parameter information. At the Berkeley 88-Ion Cyclotron, which operates under manual control, an interactive computer program has been developed to meet this requirement. The program is written in BASIC on a small off-line computer to perform a variety of calculations for any ion species and energy. The program can provide the operator with cyclotron and beam line settings for any beam, regardless of whether or not the beam has been previously run, by utilizing the broad data base acquired over a decade of heavy ion operation. A number of additional calculations now being performed conveniently and routinely by the operations staff will be discussed. The use of this program has greatly streamlined the operation of the cyclotron because needed information can be obtained quickly and reliably.

22488 **(LBL—11713) Simplified RF power system for Wideroe-type linacs.** Fugitt, J.; Howard, D.; Crosby, F.; Johnson, R.; Nolan, M.; Yuen, G. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 6p. (CONF-810314—159). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The RF system for the SuperHILAC injector linac was designed and constructed for minimum system complexity, wide dynamic range, and ease of maintenance. The final amplifier is close coupled to the linac and operates in an efficient semilinear mode, eliminating troublesome transmission lines, modulators, and high level regulators. The system has been operated at over 250 kW, 23 MHz with good regulation. The low level RF electronics are contained in a single chassis adjacent to the RF control computer, which monitors all important operating parameters. A unique 360° phase and amplitude modular is used for precise control and regulation of the accelerating voltage.

22489 **(LBL—11715) New, rugged, high power Cockcroft-Walton power supply.** Hinkson, J.; Behrsing, G.; Hazelton, E.; Hearn, W.; Lancaster, H. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 4p. (CONF-810314—142). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A ten foot (3 m), ten-stage air-insulated Crockcroft-Walton power supply designed and built at LBL has been tested to 900 kV at the SuperHILAC. Operating at 80 kHz, the power supply features low ripple, moderate stored energy, 10 ma average current, and no bouncer requirement for pulsed loads. Other system features include: inexpensive generating voltmeters and a capacitive pick off for monitoring and regulation in lieu of costly resistance dividers, home-made semiconductor rectifier modules, excellent component protection against sparking, and easy maintenance. This report describes design, construction, and testing of the high voltage system.

22490 **(LBL—11719) Physics and medicine: the Bevatron/Bevalac experience, 1979-1980.** Lothrop, F.; Alonso, J.; Force, R.; Grunder, H.; Lewis, S.; Miller, R.; Tekawa, M. (Lawrence Berkeley Lab., CA (USA)). 1981. Contract W-7405-ENG-48. 4p. (CONF-810314—162). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Heavy ion radiobiology has been integrated successfully into the research program at the Bevatron/Bevalac for the past several years. During the 1979 to 1980 year radiotherapy trials have been conducted side-by-side with the demanding program of heavy ion nuclear science research at this national facility. Careful attention is given to the scheduling of research on the SuperHILAC and Bevatron/Bevalac so that the nuclear science and biomedical programs at the Bevatron/Bevalac and the program at the SuperHILAC are served to maximum effect. Efforts to maximize the researchers' time have resulted in hardware, software, and operating improvements that offer a total machine availability of about 90% and a user availability of about 80%. Fast beam switching and beam sharing permit virtually simultaneous use of the Bevatron/Bevalac by two or more users. Current beam delivery systems will be augmented in FY 1981 to provide two ion energies per Bevatron/Bevalac pulse.

22491 **(LBL—11725) Operations experience at the Bevalac radiotherapy facility.** Alonso, J.R.; Criswell, T.L.; Howard, J.; Chu, W.T.; Singh, R.P.; Geller, D.; Nyman, M. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 3p. (CONF-810314—131). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

During the first years of Bevalac operation the biomedical effort concentrated on radiobiology work, laying the foundation for patient radiotherapy. A dedicated radiotherapy area was created in 1978, and in 1979 full-scale patient treatment was begun. As of now over 500 treatments with carbon, neon and argon beams have been delivered to about 50 patients, some as boosts from other modalities and some as complete heavy ion treatments. Up to 12 patients per day have been treated in this facility. Continuing efforts in refining techniques and operating procedures are increasing efficiency and accuracy of treatments, and are contributing to the alleviation of scheduling difficulties caused by the unique requirements of radiotherapy with human patients.

22492 **(LBL—12552) Design of focussing and guide structures for charged particle beams using rare earth cobalt permanent magnets.** Halbach, K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1981. Contract W-7405-ENG-48. 10p. (CONF-810644—1). NTIS, PC A02/MF A01.

From 5. international workshop on rare earth-cobalt magnets and their application; Dayton, OH, USA (6 Jun 1981).

A number of different methods can be used to describe the magnetic properties of oriented Rare Earth Cobalt (REC) material. It will be shown how these different methods of description lead to different ways to think about, and to execute, the design of magnets that are useful for focusing and guiding charged particle beams. It will also be domonstrated that in some of these magnets, the REC material is used in a somewhat unusual way, requiring magnetics properties of the material that are usually not considered to be of great practical importance.

22493 **(SLAC-PUB—2664) Control electronics of the PEP RF system.** Pellegrin, J.L.; Schwarz, H. (Stanford Linear Accelerator Center, CA (USA)). Jan 1981. Contract AC03-76SF00515. 2p. (CONF-810314—127). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The operation of the major components used for controlling the phase and field level of the PEP RF cavities is described. The control electronics of one RF station is composed of several control loops: each cavity has a tuners' servo loop which maintains the frequency constant and also keeps the fields of each cavity balanced; the total gap voltage developed by a pair of cavities is regulated by a gap voltage controller; finally, the phase variation along the amplification chain, the klystron and the cavities are compensated by a phase lock loop. The design criteria of each loop are set forth and the circuit implementation and test results are presented.

22494 **(SLAC-PUB—2675) Radiation and electrical safety systems for PEP.** Smith, H.; Constant, T.; Crook, K.; Fitch, J.; Taylor, T. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—157). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

At SLAC, the Personnel Protection System (PPS) protects people from radiation hazards. For PEP, the system has been expanded to include protection against electrical and RF hazards. This paper describes the overall system design, giving particular attention to the novel features not found in similar systems in other areas of SLAC. These include the Restricted Access Mode to allow limited occupancy in the ring while high voltage or RF may be present, the automatic badge reader system for improving the efficiency of entry logging and control, and the solid state lighting

control system for switching large lighting loads with minimum electro-magetic interference.

**22495 (SLAC-PUB—2677) Wigglers: the newest profession.** Spencer, J.E. (Stanford Linear Accelerator Center, CA (USA)). 1981. Contract AC03-76SF00515. 7p. (CONF-810340—11; PEP-NOTE—341). NTIS, PC A02/MF A01.

From 7. international conference on magnet technology; Karlsrube, F.R. Germany (30 Mar 1981).

Wiggler systems have been used in storage rings within the last year to increase the intensity of synchrotron radiation available for experiments as well as to increase the reaction rates in high energy physics experiments. Multiperiod wigglers or undulators have also been used recently to make quasi-monochromatic photon beams as well as amplify existing photon beams such as in the free electron laser. If one defines a wiggler to be any system of transverse, periodic electromagnetic fields, then recent results on photon production via charged particle channeling in crystals also fall within this sphere. Of course, any periodic modulation of a charge or magnetic moment (e.g., by a laser) could produce coherent radiation or, conversely, passage through a periodic aperture (e.g., a metal bellows). This discussion is limited to a typical, active, macroscopic device and how it provides some unique advantages which are practical to achieve in storage rings. As implied, the subject divides into two basic parts - one related to the radiation from the wiggler and the other related to machine physics applications, e.g., tailoring the phase space of the particle beam, modifying its damping rates or possibly optimizing a ring for production of radiation. Neither area is exhausted nor hopefully the reader, since our goal is only to present enough information to allow one to make reasonable estimates of some important effects.

**22496 (SLAC-PUB—2682) Superconducting cavities and modulated RF.** Farkas, Z.D. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—129). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

If a cavity has an infinite Q/sub o/, 81.5% of the energy contained in a pulse incident upon the cavity is transferred into the cavity by the end of the pulse if the cavity Q/sub e/ is chosen so that the cavity time constant is 0.796 pulse width (T/sub a/). As Q/sug o/ decreases, the energy in the cavity at the end of the pulse decreases very slowly as long as T/sub a/ is much less than the unloaded cavity time constant, T/sub co/. SC cavities with very high Q/sub o/ enable one to obtain very high gradients with a low power cw source. At high gradients, however, one often does not attain the high Q/sub o/ predicted by theory. Therefore, if one is inteerested in attaining maximum energy in the cavity, as is the case for RF processing and diagnostics, for a given available source energy there is no point in keeping the power on for longer than 0.1 T/sub co/ because the energy expended after 0.1 T/sub co/ is wasted. Therefore, to attain high fields at moderate Q/sub o/, pulsed operation is indicated. This note derives the fields and energy stored and dissipated in the cavity when Q/sub e/ is optimized for a given T/sub a/. It shows how to use this data to measure Q/sub o/ of an SC cavity as a function of field level, how to process the cavity with high RF fields, how to operate SC cavities in the pulsed mode to obtain higher efficiencies and gradients. Experimental results are also reported.

**22497 (SLAC-PUB—2684) PEP storage ring: current status.** Rees, J.R. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 5p. (CONF-810314—146; PEP-NOTE—347). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

This report comments on the performance of the subsystems of PEP, discusses the beam dynamical behavior of the machine and compares it with our expectations and, finally, describes plans for improving PEP.

**22498 (SLAC-PUB—2689) Prospects for very-high-gradient linac-colliders.** Wilson, P.B. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 7p. (CONF-810314—138). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The energy realistically attainable by an electron-positron storage ring is limited by the RF voltage and power requirements imposed by synchrotron radiation to about 100 GeV. To reach energies of 300 x 300 GeV and higher in a colliding beam machine of reasonable dimensions, we must look to the linac-collider operating at an energy gradient on the order of 100 MV/m. Proper choice of an RF structure or such a collider can minimize the total RF power requirement and the effects of longitudinal and transverse single-bunch beam loading. For an operating frequency in the range 4 to 6 GHz, the total RF power requirement for a 300 x 300 GeV collider with a luminosity of $10^{32}$ $cm^{-2}s^{-1}$ accelerating $10^{11}$ particles per bunch is on the order of 50 MW. To drive this collider, RF power sources are needed having a peak output power in the range 1-2 GW. Possibilities for attaining these peak power levels by direct generation and by energy storage and fast switching are discussed.

**22499 (SLAC-PUB—2691) Luminosity monitor at PEP.** Fox, J.D.; Franklin, M.E.B. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—140; PEP-NOTE—356). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The luminosity monitor system utilized by the MKII Detector and by the PEP operators is described. This system processes information from 56 photomultipliers and calculates independent luminosities for each of the 3 colliding bunches in PEP. Design considerations, measurement techniques, and sources of error in the luminosity measurement are discussed.

**22500 (SLAC-PUB—2698) Single bunch beam measurements for the proposed SLAC linear collider.** Clendenin, J.E.; Loew, G.A.; Miller, R.H.; Pellegrin, J.L.; Truher, J.B. (Stanford Linear Accelerator Center, CA (USA)). Feb 1981. Contract AC03-76SF00515. 3p. (CONF-810314—148). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Single S-band bunches of $\sim 10^9$ electrons have been used to study the characteristics of the SLAC linac in anticipation of its operation as a linear collider. Emittance measurements have been made, the longitudinal charge distribution within single bunches has been determined and transverse emittance growth has been produced by deliberately missteering the beam. New equipment is being installed and checked out, and the sensitivity of new traveling-wave beam position monitors has been measured.

**22501 (SLAC-PUB—2701) High-current injector for the proposed SLAC linear collider.** James, M.B.; Miller, R.H. (Stanford Linear Accelerator Center, CA (USA)). Mar 1981. Contract AC03-76SF00515. 3p. (CONF-810314—149). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A new, high-current injector has been designed to yield the 7.5 x $10^{10}e^-$ per S-band bunch necessary for the proposed linear collider. The injector consists of two prebunchers at the 16th subharmonic, a 0.75 c traveling wave buncher, and a three-meter velocity of light traveling wave structure. The $e^-$ beam is confined by a solonoidal magnetic field in the buncher and capture regions. A computer simulation similar to that used by Mavrogenes et al., has been used to calculate the bunching. The calculation indicates it is possible to achieve $\sim$ 1 x $10^{11}e^-$ in 16° of S-band from a 15 amp gun pulse of 1.5 nsec duration.

**22502 (SLAC-PUB—2702) Pulse to pulse klystron diagnosis system.** Nowak, J.; Davidson, V.; Genova, L.; Johnson, R.; Reagan, D. (Stanford Linear Accelerator Center, CA (USA)). Mar 1981. Contract AC03-76SF00515. 2p. (CONF-810314—128). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

This report describes a system used to study the behavior of SLAC high powered klystrons operating with a twice normal pulse

width of 5 μs. At present, up to eight of the klystrons installed along the accelerator can be operated with long pulses and monitored by this system. The report will also discuss some of the recent findings and investigations.

22503 **(SLAC-PUB—2703) Applicability of the FASTBUS standard to distributed control.** Deiss, S.R.; Downing, R.W.; Gustavson, D.B.; Larsen, R.S.; Logg, C.A.; Paffrath, L. (Stanford Linear Accelerator Center, CA (USA)). Mar 1981. Contract AC03-76SF00515. 3p. (CONF-810314—151). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The new FASTBUS standard has been designed to provide a framework for distributed processing in both experimental data acquisition and accelerator control. The features of FASTBUS which support distributed control are a priority arbitration scheme which allows intercrate as well as intracrate message flow between processors and slave devices; and a high bandwidth to permit efficient sharing of the data paths by high-speed devices. Sophisticated diagnostic aids permit system-wide error checking and/or correction. Software has been developed for large distributed systems. This consists of a system data base description, and initialization algorithms to allocate address space and establish preferred message routes. A diagnostics package is also being developed, based on an independent Ethernet-like serial link. The paper describes available hardware and software, on-going developments, and current applications.

22504 **(SLAC-PUB—2704) New generation control system at SLAC.** Melen, R. (Stanford Linear Accelerator Center, CA (USA)). Mar 1981. Contract AC03-76SF00515. 5p. (CONF-810314—150). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The proposed SLAC Linear Collider (SLC) project will require an Instrumentation and Control system that provides integrated automatic monitoring and control functions. The present SLAC LINAC Instrumentation and Control system will be totally revamped and it will be expanded to include the support of all of the additional accelerator components that will be required for the whole SLC project. This paper describes the functional operation of the new system.

22505 **(UCRL—83993) Overview of the ETA/ATA pulse power.** Reginato, L.L.; Hester, R.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 May 1980. Contract W-7405-ENG-48. 4p. (CONF-800640—21). NTIS, PC A02/MF A01.

From 14. pulse power modulator symposium; Orlando, FL, USA (3 Jun 1980).

A pulsed electron accelerator has been constructed and is now in operation at the Lawrence Livermore Laboratory. This Experimental Test Accelerator (ETA) a 5 MeV, 10 kA, 50 ns FWHM, five pulse burst at 1 kHz, was designed to be the front end or injector for the Advanced Test Accelerator (ATA). The ATA is presently under construction and will have the following parameters: beam energy - 50 MeV, beam current - 10 kA, pulse length - 70 ns, repetition rate in a ten pulse burst - 1 kHz. The parameters which make the pulse power components unique for these machines are the high repetition rate in a burst and a high degree of regulation in the system to insure pulse to pulse repeatability. Because of the larger number of components requird for ATA, a much higher degree of reliability will be required. Improvements and modifications continue to be made on the ETA, which is serving as a base of development for all ATA pulse power components. Furthermore, all ATA pulse power components will be tested at length in a test stand before beginning mass production to insure proper design to meet voltage, current, rep-rate and life requirements.

22506 **(ANL-Trans—1195) Studies on a high-grade polarized lithium-6 target.** Ulbricht, J. (Argonne National Lab., IL (USA)). Apr 1981. Translation of Ph.D. thesis, University of Hamburg, 1979. 89p. NTIS, PC A05/MF A01.

A target apparatus for nuclear spin-polarized lithium-6 nuclei was built for the 2 MeV Van de Graaff accelerator at the First Institute for Experimental Physics, and its operation has been studied. It represents a further advance of the existing atomic beam apparatus. An oxidized tungsten plate is placed in the atomic beam as the target backing to store the polarized nuclei. For the lithium-6 used in the experiments described here, a target thickness of $10^{14}$ atomic nuclei/cm$^2$ is achieved with a target area of 2 mm x 7 mm and a lithium current of 5 x $10^{13}$ atoms/sec with a typical residence time of tau ≅ 30 ms. This corresponds to a surface coverage of 0.05 monolayer. The experiments with the reaction $^6$Li vector(d,α)$^4$He have shown by comparison with the Basel measurements by R. Neff, et al. (1971) for the reaction $^6$Li(d vector,α)$^4$He that with the operating parameters used here, nuclear polarization of the lithium-6 atomic beam is completely retained on the ionizer surface. Angle distributions were measured for the first time with this high-grade polarized lithium target, and the tensor analyzer intensities of the reaction $^6$Li vector(d,α)$^4$He were determined for the deuteron energies E/sub d/ = 0.4 MeV and E/sub d/ = 0.6 MeV. These findings are in agreement with the Basel findings at E/sub d/ = 0.4 MeV, so the approximation of pure s-waves in the input channel can be regarded as satisfied here. For E/sub d/ = 0.6 MeV, the increase in the expansion coefficients of A/sub zz/ at higher angular momenta shows that this approximation is no longer valid. In deviation from the Basel findings, an increase in the analyzer intensity A/sub zz/ was found here.

22507 **Evaluation of ISABELLE full cell ultrahigh vacuum system.** Foerster, C.L.; Briggs, J.; Chou, T.S.; Stattel, P. (Accelerator Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1001-1004(Apr 1981).

The ISABELLE full cell vacuum system, consisting of a 40 m long by 8.8 cm diam stainless steel tube pumped by seven pumping stations, was assembled and processed for $10^{-12}$ Torr operation. Evaluation and testing of the system and its subassemblies has been completed. Detail design of system components and the determination of the conditioning process was completed. The best procedure to rough pump, leak test, vacuum bake the system, condition pumps, degas gauges, turn on ion pumps, and flash sublimation pumps was established. Pressures below 2 x $10^{-11}$ Torr are now routinely achieved in normal operation of the full cell. This includes pump down after replacement of various components and pump down after back fill with moist unfiltered air. The techniques developed for the full cell will be used to build the ISABELLE ultrahigh vacuum system.

22508 **(DOE/SF/00515—T1) Final accelerator inter-segment alignment procedure for sectors one and two: fabricating procedure Nos. L-2, A-8, A-11 and O-1. Assembly procedure for assembly of 40 ft segments.** (Stanford Linear Accelerator Center, CA (USA)). [nd]. Contract AC03-76SF00515. 36p. NTIS, PC A03/MF A01.

These documents describe the assembly and alignment of the typical accelerator 40-foot segments of the Stanford Linear Accelerator Center's three-kilometer linear accelerator. Required tools and special equipment are listed along with instructions for their use. Tolerances are specified for all phases of the assembly and alignment of the various components.

### 4304 Storage Rings

*REFER ALSO TO CITATION(S) 22450, 22478*

## 44 INSTRUMENTATION

### 4401 Radiation Instrumentation

*REFER ALSO TO CITATION(S) 21695, 22056, 22483, 22486, 22538, 22845*

22509 **Charge sensitive preamplifier (12 Mar 1981) (Engineering Materials).** (California Univ., Livermore (USA). Lawrence Livermore Lab.). (CAPE—2690).

3 drawings.

This charge sensitive preamplifier is used for detecting pulse produced by a germanium crystal detector, from a source of

gamma radiation, these very small electronic pulses are then amplified by the charge sensitive preamplifer. The preamp has two amplifying stages, the input stage and the high gain output stage. The input stage uses an F.E.T. for its input transistor; it operates in a vacuum cryostat very close to the germanium detector. To produce the best noise figure the F.E.T. transistor is operated at -125°C; this first amplifying stage has a voltage gain of one. The output of this first stage is sent to the high gain output stage which is external to the vacuum chamber and is operated at room temperature and has a voltage gain of five, its output impedance is 93 Ω and is designed to drive a 100 ft or more coax cable.

**22510** (CONF-801045—, pp 36-45) **Calibration of personnel radiation measurement instruments.** Bush, W.J. (EG & G Idaho, Inc., Idaho Falls); Bengston, S.J.; Kalbeitzer, F.L.; Cusimano, J.P.; Gupta, V.P. Apr 1981. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

Thermoluminescent analyzer (TLA) calibration procedures were used to estimate personnel radiation exposure levels at the Idaho National Engineering Laboratory (INEL). A statistical analysis is presented herein based on data collected over a six-month period in 1979 on four TLA's located in the Department of Energy Radiological and Environmental Sciences Laboratory at the INEL. Both gamma and beta radiation models are developed. Observed TLA readings of thermoluminescent dosimeters are correlated with known radiation levels. This correlation is then used to predict unknown radiation doses from future analyzer readings of personnel thermoluminescent dosimeters. The statistical techniques applied in this analysis include weighted linear regression, estimation of systematic and random error variances, prediction interval estimation using Scheffe's theory of calibration, the estimation of the ratio of the means of two normal bivariate distributed random variables and their corresponding confidence limits according to Kendall and Stuart, tests of normality, experimental design, a comparison between instruments, and quality control.

**22511** **(DOE/ER/00511—T1) Angular and energy resolution of the DUMAND optical array.** Stenger, V.J.; Taylor, G.N.; Roberts, A. (Hawaii Univ., Honolulu (USA)). 1978. Contract AC03-76ER00511. 6p. NTIS, PC A02/MF A01.

In an initial simulation of the response of the DUMAND optical array to the Cerenkov light from multi-TeV muons and hadronic cascades we find a muon angular resolution which is better than 15 mr above 10 TeV. The muon energy resolution is 60% at 5 TeV but improves to 45% and is approximately energy-independent above 10 TeV. The energy resolution of the hadronic cascade is given by δ E/sub H/ = 2.3 + .3E/sub H/ TeV. With these errors we can detect the presence of the W-boson propagator in deeply inelastic interactions induced by atmospheric neutrinos above 10 TeV in a few month's running with the currently conceived 1 $km^3$ array. Point sources of extraterrestrial neutrinos above a few TeV can be located to a fraction of $10^{-5}$ of the celestial sphere. Multiple muon events induced in the upper atmosphere by primary cosmic rays can be studied with the possibility of measuring the invariant mass of any supermassive objects decaying into two muons.

**22512** **Wire chambers.** Atac, M. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Instruments amp Methods ;* **176**: No. 1/2, 1-8(1 Oct 1980).

From Wire chamber conference; Vienna, Austria (27-29 Feb 1980).

Proportional wire chambers and drift chambers are discussed with respect to their applications to high energy particle physics. Some results from a resistive cathode chamber and new ideas are presented.

**22513** **Effective trigger at the Brookhaven Multi-Particle Spectrometer (MPS).** Willen, E.H. (Brookhaven National Lab., Upton, NY (USA)). *Nuclear Instruments amp Methods ;* **176**: No. 1/2, 271-276(1 Oct 1980).

From Wire chamber conference; Vienna, Austria (27-29 Feb 1980).

An effective mass trigger for use at the Brookhaven Multiparticle Spectrometer (MPS) is described. It is a microprocessor based device using extensive fast memory attached to proportional wire chambers in the MPS magnetic field. It will select kinematic quantities unique to the reaction being studied, thereby permitting higher sensitivities and a reduction in data-processing costs for MPS experiments. The principles of operation for this trigger, and the results of simulations to assess its performance, are presented.

**22514** **Hybrid shower counters for CDF.** Nodulman, L. (Argonne National Lab., IL (USA)). *Nuclear Instruments amp Methods ;* **176**: No. 1/2, 345-347(1 Oct 1980).

From Wire chamber conference; Vienna, Austria (27-29 Feb 1980).

A hybrid scintillator/strip chamber electromagnetic calorimeter has been proposed for the Collider Detector Facility at Fermilab. Large modules of lead/scintillator with wavebar readout are to contain one or more bidimensional wire chambers near shower maximum. Results of the ongoing program of computer simulation and prototype testing are discussed.

**22515** **Real-time tritium monitor with an MPC proportional response to airborne mixtures of TH and THO.** Beach, L.; Hoots, S.S. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Instruments amp Methods ;* **175**: No. 2/3, 369-377(15 Sep 1980).

A fast response tritium-in-air monitor that can detect airborne HT and HTO in proportion to the occupational maximum permissible concentration (MPC) of either species has been developed at Lawrence Livermore Laboratory. The sample gas is selectively filtered through a dimethyl silicon membrane resulting in a throughput that is 400 times greater for HTO than for HT. After filtering, the tritium is detected in a 10 $cm^3$ flow-through proportional counter. A short accumulation time, for a 5 s response to high levels of tritium (> = 1000 MPC), and a longer accumulation time, for a 60 s response to low levels of tritium (> = 10 MPC), are included. To avoid false alarms the short accumulation counter is continuously compared to a pulser set at three standard deviations above background.

**22516** **New advances in alpha spectrometry by liquid scintillation methods.** McDowell, W.J.; Case, G.N. (Oak Ridge Natl Lab, Tenn). *National Bureau of Standards (U.S.), Special Publication ;* 111-120(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Although the ability to count alpha particles by liquid scintillation methods has been long recognized, limited use has been made of the method because of problems of high background and alpha energy identification. In recent years some new developments in methods of introducing the alpha-emitting nuclide to the scintillator, in detector construction, and in electronics from processing the energy analog and time analog signals from the detector have allowed significant alleviation of the problems of alpha spectrometry by liquid scintillation. 26 refs.

**22517** **Evaluation of an I/sub III/ x-ray absorption-edge densitometer for assay of mixed uranium-plutonium solutions.** Mosley, W.C.; Thompson, M.C.; Reynolds, L.W. (DuPont, Aiken, SC). *National Bureau of Standards (U.S.), Special Publication ;* 633-650(Jun 1980). (CONF-791117—).

From ANS topical conference; Kiawah Island, SC, USA (26 Nov 1979).

Rapid, on-line, nondestructive assay of uranium and plutonium concentrations in nuclear fuel processing streams may be used to control the process and maintain accountability of special nuclear materials (SNM). An x-ray absorption-edge densitometer (XRAED) designed and built by Los Alamos Scientific Laboratory (LASL) has been evaluated at Savannah River Laboratory (SRL) for accurate assay of uranium and plutonium in process solutions. 2 refs.

## 4402 Radiation Effects On Instrument Components,

## Instruments, Or Electronic Systems

**22518 (SAND—81-0126C) Radiation-induced conductivity and high-temperature Q changes in quartz resonators.** Koehler, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 29p. (CONF-810550—1). NTIS, PC A03/MF A01.

From 35. annual frequency control symposium; Philadelphia, PA, USA (27 May 1981).

While high temperature electrolysis has proven beneficial as a technique to remove interstitial impurities from quartz, reliable indices to measure the efficacy of such a processing step are still under development. The present work is directed toward providing such an index. Two techniques have been investigated - one involves measurement of the radiation induced conductivity in quartz along the optic axis, and the second involves measurement of high temperature Q changes. Both effects originate when impurity charge compensators are released from their traps, in the first case resulting in ionic conduction and in the second case resulting in increased acoustic losses. Radiation induced conductivity measurements have been carried out with a 200 kV, 14 mA x-ray machine producing 5 rads/s. With electric fields of the order of $10^4$ V/cm, the noise level in the current measuring system is equivalent to an ionic current generated by quartz impurities in the 1 ppB range. The accuracy of the high temperature ( 300 to 800°K) $Q^{-1}$ measurement technique will be determined. A number of resonators constructed of quartz material of different impurity contents have been tested and both the radiation induced conductivity and the high temperature $Q^{-1}$ results compared with earlier radiation induced frequency and resonator resistance changes. 10 figures.

### 4403 Miscellaneous Instruments

*REFER ALSO TO CITATION(S) 22442*

**22519 (LA-UR—81-1074) Ultraviolet-spectrograph lens.** Brixner, B.; Winkler, M.A. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 10p. (CONF-810429—10). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

A 700-mm f/4.7 spectrograph camera lens was designed for imaging spectral lines in the 200- to 400-nm region on a 120-mm flat image field. Lens elements of fused silica and crystal calcium fluoride give such good achromatization that raytracing calculations predict a resolution limit of 30 lines/mm without refocusing in the 238- to 365-nm region. Light scattering at the polished calcium-fluoride surfaces is avoided by sandwiching the fluoride elements between fused silica and cementing with silicone fluid. The constructed lens makes good spectrograms.

**22520 (LA-UR—81-1126) Nanosecond-gating properties of proximity-focused microchannel-plate image intensifiers.** King, N.S.P.; Yates, G.J.; Jaramillo, S.A.; Ogle, J.W.; Detch, J.L. Jr. (Los Alamos National Lab., NM (USA); EG and G, Inc., Santa Barbara, CA (USA)). 1981. Contract W-7405-ENG-36. 22p. (CONF-810429—18). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

Some fundamental properties of 18-mm-diam gated proximity-focussed microchannel-plate (MCP) image intensifiers used as fast image shutters in the 1 to 10 ns range have been identified and studied. Light pulses (~ 5 ps wide) from a modelocked dye laser optically sample the gated MCP. Shuttering is achieved by applying a forward-biasing electrical gate pulse to the quiescently reverse-biased photocathode-MCP interface. Variable delay (~ 30 ps jitter) between the gate pulse and the laser pulse permits tracing the MCP's optical response. Gating speeds, turn-on and turn-off patterns, the asymmetric spatial dependence of the MCP optical response, and resolution effects as functions of gate pulse width and photocathode-MCP bias have been characterized. Shutter times of >750 ps with ~ 5 lp/mm resolution were observed. Variations in the intensity profiles of the phosphor's spatial response for uniform photocathode illumination are measured with a calibrated silicon-intensified-target (SIT) focus projection, scan (FPS) television camera and a high-speed video digitizer while photomultipliers monitor the laser pulse and the phosphor's spatially integrated output intensities. The characterization system, gating and biasing circuits, and experimental results will be presented.

### 4404 Well Logging Instrumentation

**22521 (SAND—81-0196) Development and testing of FIDELE: a computer code for finite-difference solution to harmonic magnetic-dipole excitation of an azimuthally symmetric horizontally and radially layered earth.** Vittitoe, C.N. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 59p. NTIS, PC A04/MF A01.

The FORTRAN IV computer code FIDELE simulates the high-frequency electrical logging of a well in which induction and receiving coils are mounted in an instrument sonde immersed in a drilling fluid. The fluid invades layers of surrounding rock in an azimuthally symmetric pattern, superimposing radial layering upon the horizonally layered earth. Maxwell's equations are reduced to a second-order elliptic differential equation for the azimuthal electric-field intensity. The equation is solved at each spatial position where the complex dielectric constant, magnetic permeability, and electrical conductivity have been assigned. Receiver response is given as the complex open-circuit voltage on receiver coils. The logging operation is simulated by a succession of such solutions as the sonde traverses the borehole. Test problems verify consistency with available results for simple geometries. The code's main advantage is its treatment of a two-dimensional earth; its chief disadvantage is the large computer time required for typical problems. Possible code improvements are noted. Use of the computer code is outlined, and tests of most code features are presented.

## 45 EXPLOSIONS AND EXPLOSIVES

### 4501 Chemical

**22522 (LA-UR—81-992) Manufacture of triaminotrinitrobenzene.** Benziger, T.M. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 16p. (CONF-810712—1). NTIS, PC A02/MF A01.

From Annual conference on chemical and mechanical technologies of propellants and explosives; Karlsrube, F.R. Germany (1 Jul 1981).

Process studies were made on the preparation of triaminotrinitrobenzene (TATB), an explosive of unusual insensitivity and high thermal stability. Reaction conditions and procedures were determined that allowed its practical manufacture in batch reactors on a 200-kg scale.

**22523 (LA-UR—81-1067) Detonation pressures of PBX-9404, composition B, PBX-9502, and nitromethane.** Davis, W.C.; Ramsay, J.B. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 9p. (CONF-810602—25). NTIS, PC A02/MF A01.

From 7. symposium on detonation; Annapolis, MD, USA (19 Jun 1981).

Measurements of detonation pressure for PBX-9404, Composition B, PBX-9502, and nitromethane are presented. The interpretations of the data are discussed, and the implications are compared with results from other experiments. The pressures are considered from the point of view of their use as calibrations for calculations, and suggestions are given for slight changes from the measured value for use with limited calculation procedures.

**22524 (LA-UR—81-1270) PHERMEX applications to study high-pressure flow and detonation waves.** Dick, R.D. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 34p. (CONF-810540—1). NTIS, PC A03/MF A01.

From 1. European conference on cineradiography with photons or particles; Paris, France (19 May 1981).

Pulsed High-Energy Radiographic Machine Emitting X Rays (PHERMEX), has been used as a diagnostic tool to make

quantitative measurements from radiographs of inert materials under dynamic high-pressure conditions and of explosives during the detonation process. In some experiments, radiography is the best method (compared to high-speed optical cameras and contactor pins) to study complicated hydrodynamic flow occurring in a dynamic experiment. To demonstrate the versatility and uniqueness of PHERMEX and the radiographic method, several experiments on inert solids having high and low atomic numbers will be discussed with some particulars. This includes the observation of the 11.0-GPa-pressure phase transition for antimony and the accompanying two-shock structure and the off-Hugoniot data for lead using regular reflection. Also, by careful design of a radiographic experiment, the Hugoniot state behind a shock front can be completely and precisely specified. Aluminum is an example of a material studies in this manner. PHERMEX is useful in studying some detonation properties of explosives. As an illustration, the discussion will include radiographic results of divergence characteristics of a detonation wave in sensitive and insensitive explosives as it propagates past a corner and the effect of preshocking on the detonation process of insensitive explosives when the detonation wave interacts with a region that has been shock-compressed at a pressure too low to cause detonation.

22525 **(MHSMP—81-25) Formulation of PBX 9503.** Stallings, T.L.; Osborn, A.G. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). May 1981. Contract AC04-76DP00487. 9p. NTIS, PC A02/MF A01.

A formulation process was developed for the TATB/HMX/Kel-F composition, PBX 9503, on a 30-litre scale which yielded an acceptable product. Attempts to scale this process to larger reactors gave a non-homogeneous product and a mottled texture in pressed pellets of PBX 9503. This is believed due to less turbulent agitation in the larger reactors.

22526 **(SAND—80-1880C) Project PROPA-GATOR: intermediate range explosion airblast propagation measurements.** Reed, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1980. Contract AC04-76DP00789. 20p. (CONF-800941—3; CONF-810371—1). NTIS, PC A02/MF A01.

From 19. DOD explosives safety seminar; Los Angeles, CA, USA (9 Sep 1980).

Several hundred explosions of flaked TNT, ranging in charge weight from 2.3 kg to 1145 kg were fired at the NASA Kennedy Space Center, Florida, in March and June, 1979. Comprehensive meteorological measurements were made by rawinsonde balloons and on a nearby 150 m tower, including winds, turbulence, temperatures, and humidity. A cruciform array of airblast gages was operated, with gages at 200 m, 500 m, 1 km, 2 km, and 5 km ranges from the explosions. For some events as many as six microbarographs were operated at distances to 25 km. Airblast results have been correlated against refractive atmospheric conditions, establishing a functional relationship between overpressure decay with distance and the sound velocity gradient with height.

22527 **(UCRL—15334) 150mm launcher facility for shockwave compression experiments: a critical review and conceptual design study.** Swift, H.F. (International Applied Physics, Inc., Dayton, OH (USA)). Jan 1981. Contract W-7405-ENG-48. 74p. NTIS, PC A04/MF A01.

Lawrence Livermore Laboratory is considering construction of a large planar shockwave facility using a 150 mm launcher. The facility will be used to study explosive initiation which places serious constraints upon facility design. It is recommended that the projectile be guided to the target along expendable plastic rails that will not produce shrapnel when shattered and allow the system to operate effectively under mild evacuation. The launcher employs an 18 m long launch tube with both solid propellent and cold-gas chambers to launch packages weighing up to 9 kg to velocities between 0.2 and 2 km/s. Unique hardware designs are suggested for coupling launch tube segments and connecting chambers. The launch tube is supported on a base via bearinged carts that allow 3 m of axial motion for maintenance/assembly. Chambers are supported on carts that roll on floor-mounted rails during launcher assembly/disassembly and operation.

## 4502 Nuclear

22528 **(EGG—1183-4221) EG and G support to LLNL, 1 January 1981-31 March 1981.** (EG and G, Inc., San Ramon, CA (USA). Energy Measurements Group). May 1981. Contract AC08-76NV01183. 59p. NTIS, PC A04/MF A01.

The contributions made by EG and G Divisions to Lawrence Livermore National Laboratory programs during January through March 1981 are summarized. These activities include: control and command functions at the Nevada Test Site (NTS); data acquisition and processing for NTS events; design, fabrication and field support associated with experimental hardware; containment instrumentation; electronic engineering; CRT support; lightguide data acquisition; LINAC utilization; nuclear detection system development; and high-speed camera systems for laser fusion and weapons diagnostics studies. (LCL)

22529 **(UCRL—52934) Radiochemical data collected on events from which radioactivity escaped beyond the borders of the Nevada test range complex.** Hicks, H.G. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 12 Feb 1981. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01.

This report identifies all nuclear events in Nevada that are known to have sent radioactivity beyond the borders of the test range complex. There have been 177 such tests, representing seven different types: nuclear detonations in the atmosphere, nuclear excavation events, nuclear safety events, underground nuclear events that inadvertently seeped or vented to the atmosphere, dispersion of plutonium and/or uranium by chemical high explosives, nuclear rocket engine tests, and nuclear ramjet engine tests. The source term for each of these events is given, together with the data base from which it was derived (except where the data are classified). The computer programs used for organizing and processing the data base and calculating radionuclide production are described and included, together with the input and output data and details of the calculations. This is the basic formation needed to make computer modeling studies of the fallout from any of these 177 events.

22530 **(UCRL—85730) On-board data recorder for hard-target weapons.** Niven, W.A.; Jaroska, M.F. (Lawrence Livermore National Lab., CA (USA)). 16 Mar 1981. Contract W-7405-ENG-48. 16p. (CONF-810367—2). NTIS, PC A02/MF A01.

From Fuze section annual meeting (ADPA); San Diego, CA, USA (17 Mar 1981).

The Naval Weapons Center has several hard target penetration weapons development programs in progress. One of the critical problem areas in these programs is the extreme difficulty of measuring acceleration-time data from penetration tests due to the hostile nature of the environment. The information is of vital importance in order to produce survivability design criteria for components expected to function in such severe environments. The development of a small, rugged, solid state on-board recorder to capture dynamic data for hard target penetration weapon testing is described.

## 4503 Explosion Detection

*REFER ALSO TO CITATION(S) 22920*

# 50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

22531 **Examination of some simple numerical schemes for calculating scalar advection.** Long, P.E. Jr.; Pepper, D.W. (Savannah River Laboratory, E. I. du Pont de Nemours & Company, Aiken, SC 29809). DE-AC09-76SR00001. *Journal of Applied Meteorology ;* **20**: No. 2, 146-169(Feb 1981).

The computational damping and dispersion errors of some simple numerical schemes for calculating the advection of a scalar are analyzed. Computation times and accuracy are compared in calculating the two-dimensional transport of a symmetrical distribution in a uniform rotational flow field. Amplification factors, computational phase velocities and effective diffusion coefficients are used

to examine the properties of the schemes. Simple tests show that the more accurate methods do not require significantly more computing times in both one- and two-dimensional constant and variable flows.

## 5001 Basic Studies

*REFER ALSO TO CITATION(S) 21752*

22532 **(LBL—12540) Role of black carbon in the organic chemistry of atmospheric aerosols.** Gundel, L.A.; Dod, R.L.; Hansen, A.D.A.; Rosen, H.; Chang, S.G.; Novakov, T. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 7p. (CONF-810475—2). NTIS, PC A02/MF A01.

From Workshop on physics and chemistry of energy-related atmospheric pollution; Harper's Ferry, WV, USA (21 Apr 1981).

Black carbon plays a significant role in the physics and chemistry of atmospheric aerosols because of its optical absorptivity, adsorption capacity, and surface characteristics. These properties affect the composition and chemical behavior of the associated organic material. Gas chromatographic and mass spectral studies indicate that particulate organic material contains unburned and partially oxidized fuel hydrocarbons, polynuclear aromatic hydrocarbons, and polyfunctional oxygenated compounds which may be formed in the atmosphere by reactions of hydrocarbons with atmospheric or pollutant gases. Carbonaceous aerosols were characterized using combustion evolved gas analysis (thermal analysis) with simultaneous optical attenuation measurements and selective solvent extraction. Thermograms of urban aerosols typically exhibit three broad peaks when evolved $CO_2$ concentration is plotted versus heating temperature. Sample thermograms are shown. Field and characterization studies indicate that the ratios of secondary to primary carbon in urban particulate matter are similar for samples collected in Berkeley, Los Angeles, and New York City, irrespective of the level of photochemical activity at the sampling sites. The fraction of black carbon to total carbon in urban carbonaceous particles is approximately constant, independent of sampling location or time of year.

22533 **(UCRL—85958) Study of the global energy balance.** Ellingson, R.G.; MacCracken, M.C. (Maryland Univ., College Park (USA). Dept. of Meteorology; Lawrence Livermore National Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 9p. (CONF-810638—1). NTIS, PC A02/MF A01.

From 4. conference on atmospheric radiation; Toronto, Ontario, Canada (16 Jun 1981).

The purpose of this study is threefold. First, we wish to define a self consistent energy budget of the major components of the observed earth-atmosphere system. Second, we intend to compare these budgets to those calculated by a particular climate model, ZAM2 (Ellsaesser et al., (1976); Potter et al., (1979)) for the current climate. Finally, we will examine the changes of the component budgets as we double the atmospheric $CO_2$ concentration. In this manner we hope to illustrate and better understand the interaction between the various components in a system in which a seemingly small change in the longwave radiation balance is amplified into a relatively large change in the surface temperature. Because of the complexities of the various terms considered, this paper only summarizes some of the research in progress. Section 2 outlines our component atmosphere, section 3 describes the climate model and section 4 summarizes some of the effects of doubling $CO_2$.

22534 **Scheme for computing surface fluxes from mean flow observations.** Hoffert, M.I. (New York Univ., NY); Storch, J. Contract EY-C-02-0016. *Boundary-Layer Meteorology ;* **17**: 429-442(1979).

A computational scheme is developed for estimating turbulent surface stress, sensible heat flux and humidity flux from mean velocity, temperature and humidity at a single height in the atmospheric surface layer; conditions at this reference level are presumed known from observations or from a numerical atmospheric circulation model. The method is based on coupling a Monin-Obukhov similarity profile to a force-restore formulation for the evolution of surface soil temperature to yield the local values of shear stress, heat flux and surface temperature. A self-contained formulation is presented including parameterizations for solar and infrared radiant flux at the surface. In addition to reference-level mean flow properties, the parameters needed to implement the scheme are thermal heat capacity of the soil, surface aerodynamic roughness, latitude, solar declination, surface albedo, surface emissivity and atmospheric transmissivity. Sample calculations are presented for (a), constant atmospheric forcing at the reference level, and (b) variable atmospheric forcing corresponding to Kahle's (1977) measurements of windspeed, air temperature and radiometer soil surface temperature under dry vegetatively sparse conditions in the Mohave Desert in California. The latter case simulated the observed diurnal variations reasonably well for the parameters used.

## 5002 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 21540, 21541, 21541, 21596, 22104, 22369, 22414, 22464, 22465, 22703*

22535 **(ANL/EES-TM—129) In pursuit of clean air: a data book of problems and strategies at the state level. Supplement.** Garvey, D.B.; Moser, S.B.; Streets, D.G. (Argonne National Lab., IL (USA)). Aug 1980. Contract W-31-109-ENG-38. 288p. NTIS, PC A13/MF A01.

The Clean Air Act Amendments of 1977 and EPA regulations set stringent requirements for the control of emissions in areas where the National Ambient Air Quality Standards were being exceeded. This supplement updates a previous five-volume summary of nonattainment area designations and attainment strategies of the states as of July 1, 1980. It also contains maps of PSD Class I areas and additional information on coal production, coal reserves, and coal quality.

22536 (ANL/EES-TM—130, pp 26-40) **Estimated ambient $SO_2$ and $SO_4$ impacts.** Oct 1980. NTIS, PC A05/MF A01.

In Air quality analysis of Phase I of the proposed oil backout legislation.

In this section, the $SO_2$ emissions increases projected in Sec. 2 are related to expected increases in ambient concentrations of $SO_2$ and its reaction product, sulfate ($SO_4$). It is beyond the scope of this analysis to perform local ambient air quality modeling for all 50 power plants contained in the legislation. A compromise was achieved by performing local air quality modeling, using the RAM model, on the cluster of power plants in the metropolitan New York City area, where impacts are intuitively expected to be largest; and by using a semi-empirical matrix model to estimate regional air quality changes.

22537 (ANL/EES-TM—130, pp 41-50) **Regional and national NO/sub x/ emissions.** Oct 1980. NTIS, PC A05/MF A01.

In Air quality analysis of Phase I of the proposed oil backout legislation.

Significant increases in emissions of nitrogen oxides (NO/sub x/) might be anticipated when units convert from oil or gas to coal, because of the generally higher NO/sub x/ emissions associated with coal combustion. Although ambient concentrations of NO/sub x/ are generally well below NAAQS, increases in emissions are of concern because of the implications for acid precipitation. To predict accurately what these increases might be is difficult, however, because NO/sub x/ emission rates are sensitive to peak combustion temperatures and are therefore very much dependent on the firing mechanisms, boiler types, and operating characteristics of the individual units. The analysis that follows determines on a unit-by-unit basis what emissions changes might result from conversion, taking into account the firing method used, the size of the unit, and the quantity of oil burned by that unit.

22538 **(CONF-801045—) Proceedings of the 1980 DOE statistical symposium.** Truett, T.; Margolies, D.; Mensing, R.W. (comps.). (Oak Ridge National Lab., TN (USA)). Apr 1981. Contract W-7405-ENG-26. 239p. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

Separate abstracts were prepared for 8 of the 16 papers presented at the DOE Statistical Symposium in California in October 1980. The topics of those papers not included cover the relative detection efficiency on sets of irradiated fuel elements, estimating failure rates for pumps in nuclear reactors, estimating fragility functions, application of bounded-influence regression, the influence function method applied to energy time series data, reliability problems in power generation systems and uncertainty analysis associated with radioactive waste disposal. The other 8 papers have previously been added to the data base. (KRM)

22539 (CONF-801045—, pp 47-58) **Simple models and the comparison of monitoring rules related to National Ambient Air Quality Standards.** Bishop, T.A. (Battelle Memorial Inst., Columbus Division, OH); Price, B.; McNealey, J.J. Apr 1981. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

Plans to increase the use of coal for generating electric power must include consideration of the impact on air quality. The US Environmental Protection Agency has initiated a review of policies and procedures for regulating large coal-fired boilers. The emphasis of the review is on the variability in sulfur dioxide emissions and the role of averaging times in establishing a reference standard. In this paper, a probabilistic modeling approach is described that is used to compare characteristics of existing and proposed air quality standards. The characteristics considered are averaging times, reference standards, and probabilities of being in violation of the standard.

22540 (CONF-801045—, pp 127-131) **n-dimensional pattern recognition in environmental systems.** Farrell, M.P.; Strand, R.H. (Oak Ridge National Lab., TN). Apr 1981. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

A methodology has been developed for analyzing relationships among variables in n-dimensional systems that are typified by large sample sizes. The methodology includes graphical cinematography techniques in combination with appropriate variables to allow a visual comparison of relationships that are either linear or nonlinear in character. Four variables - carbon monoxide, day of month, hour of day, and level within gasifier - were selected to illustrate the methodology. The variables are part of a study involving process monitoring of the University of Minnesota-Duluth coal gasification facility. The results show patterns that may be overlooked by manual inspection or may be smoothed by statistical techniques. This methodology is useful in observing episodic patterns as well as trend patterns.

22541 (CONF-801045—, pp 201-205) **Adjusting survival data for covariates.** Tolley, H.D. (Pacific Northwest Lab., Richland, WA). Apr 1981. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

The methods for adjustment of the effects of covariables either in parametric (ANOVA) or nonparametric models usually assume that the covariable be independent of the randomized assignment of treatments. Deviations from this basic assumption require special consideration even in the standard analysis of variance set up. Increasingly, however, researchers are encountering such dependent covariable models. This paper considers the problem of adjusting for such time-dependent covariates in survival models. Particular attention is given to the Cox, or proportional hazards, model.

22542 **(DP-MS—80-84) Modeling pollutant dispersion within a tornadic thunderstorm.** Pepper, D.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 15p. (CONF-810702—7). NTIS, PC A02/MF A01.

From International conference on numerical methods for laminar and turbulent flow; Venice, Italy (13 Jul 1981).

A three-dimensional numerical model was developed to calculate ground-level air concentration and deposition of particles entrained in a tornadic thunderstorm. The rotational characteristics of the tornadic storm are within the larger mesoscale flow of the storm system and transported with the vortex. Turbulence exchange coefficients are based on empirical values. The quasi-Lagrangian method of moments is used to model the transport of concentration within a grid cell volume. Results indicate that updrafts and downdrafts, coupled with scavenging of particles by precipitation, account for most of the material being deposited closer to the site than anticipated. Approximately 5% of the pollutant is dispersed into the stratosphere.

22543 **(DP-MS—80-85) Computational codes for calculating dispersion from accidental releases of pollutants.** Pepper, D.W.; Cooper, R.E.; Baker, A.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Tennessee Univ., Knoxville (USA)). 1981. Contract AC09-76SR00001. 14p. (CONF-810702—8). NTIS, PC A02/MF A01.

From International conference on numerical methods for laminar and turbulent flow; Venice, Italy (13 Jul 1981).

A modular, data-based system approach was developed to facilitate computational simulation of multi-dimensional pollutant dispersion in atmospheric, stream, estuary, and groundwater applications. This system is used to assess effects of accidental releases of pollutants to the environment. Model sophistication ranges from simple statistical to complete three-dimensional numerical methods. The system used specifies desired degree of model sophistication from a terminal. The model used depends on the particular type of problem being solved, and on a basis of merit related to computer cost. The results of prediction for several model problems are presented.

22544 **(EPA-AA-TEB—81-11) Mobile source emission inventory.** Wolcott, M. (Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.). Dec 1980. 59p. Environmental Protection Agency, Office of Air, Noise and Radiation, Ann Arbor, MI.

Within the Office of Mobile Source Air Pollution Control (OMSAPC), a Program Assessment Group has been established to evaluate and direct mobile source control programs. This paper focuses on one input into that evaluation, the development of emission inventory estimates for a variety of mobile pollution sources. Both current (1977) and future (up to 2005) year inventories are estimated. Eighteen different types of mobile sources are considered in order to ascertain the contribution of unregulated as well as presently regulated sources. Virtually all counties in the United States and its territories are included for one portion of the analysis. The majority of the analyses include only those counties that have the potential to violate the National Ambient Air Quality Standard (NAAQS) for carbon monoxide, ozone, or nitrogen oxides. Future baseline emissions, founded on a set of assumptions consistent with past air quality analyses, are projected. From this baseline the sensitivity of those estimates to the underlying assumptions used is examined. Twelve sensitivity scenarios are considered. In each scenario one of the baseline assumptions is altered. Then, the result of the alteration is interpreted in terms of its likely air quality impact. It is concluded that mobile sources will account for a large proportion of county emissions. The recent downward trend in total emissions is expected to be reversed. If the quality of air in our cities is to be improved, emissions from both mobile and stationary sources will have to be controlled to a degree greater than is presently projected.

22545 **(EPRI-EA—1913) Emissions inventory for the SURE Region. Final report.** Klemm, H.A.; Brennan, R.J. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Apr 1981. 293p. NTIS, PC A13/MF A01.

One purpose of the Sulfate Regional Experiment (SURE) program is to define the mechanisms that link emissions to ambient concentrations of sulfur dioxide and sulfates and subsequently develop a useful air quality model that relates emissions to ambient concentrations. Described in this report is the phase of the SURE program involved with the development of a detailed emissions inventory. Inventories were prepared for all man-made stationary sources of emissions and surface transportation emissions. Variations in emissions by season, from weekday to weekend, and for eight 3-hour periods throughout the day were reported. Estimates of emissions of sulfur dioxide, sulfate,particulate matter, nitrogen

monoxide, nitrogen dioxide, and three classes of hydrocarbons were prepared. Inventories of sulfur dioxide and sulfate emissions from electric utility sources in the region were prepared for August and October 1977, January 10 to February 9, 1978, April 3 to May 2, 1978, and July 1978. Hourly variations on a point-by-point basis were reported. Relationships between emission rates and external factors that influence those rates were investigated for different source types. Finally, a detailed analysis of the accuracy of the emissions was performed. A unique feature of this inventory was the acquisition of hourly $SO_2$ emission rates from electric power plants during those months when the SURE intensive measurements were conducted. This detailed data base, along with the longer term emissions estimates, showed that total $SO_2$ emissions over the SURE region varied by no more than 15%. It was found that fossil-fueled power plants emit between 50 and 60% of the $SO_2$, depending on the season, and approximately 30% of the NO. Approximately 80% of the pollutants emitted from power plants are confined within the lower 300m (1000 ft.) of the atmosphere, i.e., the bulk of these pollutants is confined within the mixed layer.

**22546 (LBL—12539) Determination of relative concentrations of primary and secondary organics and speciation of sulfur compounds by thermal analysis and photoelectron spectroscopy.** Novakov, T.; Dod, R.L.; Gundel, L.A.; Hansen, A.D.A. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 8p. (CONF-810475—1). NTIS, PC A02/MF A01.

From Workshop on physics and chemistry of energy-related atmospheric pollution; Harper's Ferry, WV, USA (21 Apr 1981).

Carbon-, sulfur-, and nitrogen-containing particles account for most of the anthropogenic aerosol particle burden. Methodology developed to quantitate the amounts of primary and secondary particulate carbon data are presented on speciation of sulfur compounds by a novel approach using thermal analysis and photoelectron spectroscopy (ESCA).

**22547 (UCID—19040) Comparison of observed and model-predicted $O_3$ trends.** Penner, J.E. (Lawrence Livermore National Lab., CA (USA)). 13 May 1981. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01.

Model predictions for trends in atmospheric ozone concentrations are compared to the detection threshold for total $O_3$ developed by London (1981). (ACR)

**22548 Effect of temperature feedback and hydrostatic adjustment in a stratospheric model.** Penner, J.E.; Luther, F.M. (Lawrence Livermore National Laboratory, University of California, Livermore 94550). W-7405-ENG-48. *Journal of the Atmospheric Sciences ;* **38**: No. 2, 446-453(Feb 1981).

Calculated perturbations to stratospheric ozone are generally thought to be reduced when temperature feedback is included in the model. We find that when self-consistent hydrostatic adjustment is included with temperature feedback, there can be significant differences in the computed change in local ozone concentration. We present results in two frames of reference (changes in ozone at constant altitude and changes at constant pressure) to illustrate the importance of the frame of reference. Including hydrostatic adjustment is particularly important for calculations of the change in local ozone at constant altitude due to CFM, $CO_2$ and $H_2O$ perturbations because large changes in the temperature structure are predicted. Only small differences are computed for increases in $N_2O$. Air density adjustment in a constant pressure frame of reference is important when local temperature changes are large.

**22549 Comparison between polluted and clean air masses over Lake Michigan.** Alkezweeny, A.J.; Laulainen, N.S. (Battelle, Pacific Northwest Laboratory, Richland, WA 99352). DE-AC06-76RLO-1830. *Journal of Applied Meteorology ;* **20**: No. 2, 209-212(Feb 1981).

Clean and polluted air masses, advected over Lake Michigan, were studied using instrumental aircraft during the summers of 1976 and 1978. The results show that regardless of the degree of pollution, the particle size distribution is bimodal. The concentrations of sulfate, nitrate and trace metals in a clean air mass are more than an order of magnitude lower than those in polluted air masses. Furthermore, these concentrations are comparable with those measured in remote areas of the world. In clean air the ratio of the total light scattering to Rayleigh scattering is very close to one, indicating very low concentrations of particulates in the optically active size classes.

**22550 Atmospheric carbon dioxide, the southern oscillation, and the weak 1975 El Nino.** Bacostow, R.B. (Univ. of California, San Diego, La Jolla); Adams, J.A.; Keeling, C.D.; Moss, D.J.; Whorf, T.P.; Wong, C.S. *Science ;* **210**: 66-68(3 Oct 1980).

The observed rate of change of the atmospheric carbon dioxide concentration at the South Pole, Fanning Island, Hawaii, and ocean weather station P correlates with an index of the southern oscillation and with El Nino occurrences. There are changes at all four stations that seem to be in response to the weak 1975 El Nino. Thus, even poorly developed El Nino events may affect the atmospheric carbon dioxide concentration.

**22551 Environmental toxicology: issues, problems, and challenges.** Aurbach, S.I.; Gehrs, C.W. (Oak Ridge National Lab., TN). pp 23-39 of Scientific basis of toxicity assessment. Witschi, H. (ed.). New York, NY; Elsevier/North-Holland Biomedical Press (1980).

Environmental toxicology (from an ecological perspective) can have several applications to the broader field of toxicology. An important role, perhaps, is identifying and quantifying potential pathways of toxicants to man. The recently enacted Toxic Substances Control Act and Resource Conservation and Recovery Act bear witness to the public awareness of and concern with environmental transport and the need for developing predictive capabilities. Any assessment of the potential risks to people must be built on an understanding of the movement and fate of materials in the environment. While the primary concern of environmental toxicologists is related to the impact of toxic substances on man directly or indirectly, one must bear in mind that the potential impact of toxic substances upon the environment per se can be construed as another aspect of ecotoxicology. To the extent that introduced chemicals have a potential for degrading key components of the environment or for damaging gene pools through selective mortality of organisms, these areas become of concern to the ecologist.

## 5003 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 22529, 22543, 22672, 22987*

**22552 (FERMILAB—81/26) Environmental monitoring report for calendar year 1980.** Baker, S.I. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1 May 1981. Contract AC02-76CH03000. 72p. NTIS, PC A04/MF A01.

The accelerator operated routinely at 400 GeV during CY-1980 with about half the number of protons accelerated during CY-1980 as in CY-1979. The total number of protons accelerated in 1980 was $1.2 \times 10^{19}$. The lower total was the result of an extended shutdown from the end of June until the middle of November for construction and because of a shortage of operating funds. During CY-1980 there were no abnormal occurrences which had an impact on the facility and its operation. The maximum potential radiation exposure at the site boundary during CY-1980 was 0.3 mrem compared to 2 mrem last year. The total potential radiation exposure to the general off-site population from Fermilab operations during CY-1980 was 1 person-rem compared to 3 person-rem last year. Airborne radioactivity was released across the site boundary in small amounts throughout the year from the stacks ventilating a Neutrino Area enclosure where the proton beam strikes a target. The radioactive gas was primarily $^{11}C$, total quantity released was 1.3 kCi, and the maximum dose at the site boundary was 0.3 mrem for 1980. There was also a controlled release of tritium produced in helium gas near a target in the Meson Area. The total amount of tritium released was 240 mCi. The average tritium concentration at the site boundary was about 0.00001 percent of the Concentration Guide (Sections 3.2 and 4), resulting in a negligible off-site exposure. The off-site release of tritium in surface water totaled 240 mCi, five times last year's release, primarily because water flowed off the site for 7.5 months compared to less than two months in 1979.

### 5006 Regulations

*REFER ALSO TO CITATION(S) 22535*

**22553** (ANL/EES-TM—130, pp 66-75) **Assessment of the proposed legislation.** Oct 1980. NTIS, PC A05/MF A01.

In Air quality analysis of Phase I of the proposed oil backout legislation.

The purpose of the proposed legislation is to reduce the consumption of oil and gas in electric utility power plants by substituting coal. The substitution of coal would increase emissions of $SO_2$ and NO/sub x/ to the environment, and costs of fuel and pollution control equipment would be incurred. Therefore, there is a conflict among three competing desires: to reduce oil consumption, to minimize environmental insult, and to minimize costs to utilities. This section will discuss this conflict and attempt to determine an optimal solution.

## 51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

### 5101 Basic Studies

*REFER ALSO TO CITATION(S) 22571, 22574, 22575, 22576, 22577, 22579, 22580, 22581*

**22554** (CONF-8009140—, pp 2-4) **Terrestrial sources of organic carbon.** Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

The first step in determining the role of rivers in the global carbon cycle is to identify the terrestrial sources of carbon. There are three categories of carbon transported by rivers: (1) particulate organic carbon (POC), including leaf litter, woody debris and soil organics; (2) dissolved organic carbon (DOC), resulting from leaching and decomposition of organic carbon in plants and soils; and (3) dissolved inorganic carbon (DIC), such as bicarbonate and carbonate ions and dissolved carbon dioxide.

**22555** (CONF-8009140—, pp 46-74) **Use of carbon isotope measurements to examine the movement of labile and refractory carbon in soil.** O'Brien, B.J.; Stout, J.D.; Goh, K.M. (Inst. of Nuclear Sciences, Lower Hutt, New Zealand). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

From extensive measurements of $^{13}C$ and $^{14}C$ in soil and plant components it has become possible to model the carbon movement and turnover in soil. Carbon-14 and $^{13}C$ measurements have also been made on carbon cmponents in ground waters. In this report we review some data for New Zealand and indicate how carbon isotope measurements can help us to understand the movement of carbon from plant to soil to ground water.

### 5102 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 22104, 22551, 22586*

### 5103 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 21640, 21691, 22552, 22672*

**22556** **(LA-UR—81-1175) Deposition and retention of plutonium in the United States general population.** McInroy, J.F.; Boyd, H.A.; Eutsler, B.C. (Los Alamos National Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 33p. (CONF-791077—8). NTIS, PC A03/MF A01.

From Workshop on measurement and interpretation of actinide accumulation by man; Snowbird, UT, USA (14 Oct 1979).

Since 1959, a Los Alamos National Laboratory study has analyzed over 5000 tissues from 1100 individuals of the nonoccupationally exposed general population for fallout plutonium. These data have been useful in determining the tissue distributions and the annual baseline levels of environmental plutonium in the United States population. The effects of age, sex, date of death, cause of death and geographic location of resididence on the observed plutonium deposition have been evaluated. Because of the difference in biological turnover times of plutonium in the various organs of the body and the changing concentrations of plutonium in the atmosphere, the plutonium concentration ratios between tissues have changed as a function of time. However, our data indicate that over the past 10 years, the highest concentrations in the general population are found in the tracheobronchial lymph nodes and the liver and the lowest concentrations are in the spleen, gonads and kidney. The median body burdens of plutonium in the US population are estimated to have reached 12 pCi during the 1960's and have declined to about 2 pCi in 1977. Large errors in estimated skeletal burdens of plutonium may exist because of small specimen sample sizes and a lack of knowledge concerning the relative distribution of plutonium among the various bones of the human body.

### 5105 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 21553, 21565*

**22557** **(CONF-810531—1) Energy conservation through site planning: a systems approach.** Wendt, R.L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01.

From 3. annual site development and land use planning conference; Batavia, IL, USA (5 May 1981).

An abstract, describing the systems approach for selecting a site for a facility, is presented. Integrating the site with its environment is discussed. Parameters for selecting a site for a junior college in Oak Ridge to save energy and money are described. (MCW)

## 52 ENVIRONMENTAL SCIENCES, AQUATIC

### 5201 Basic Studies

*REFER ALSO TO CITATION(S) 22555, 22609, 22655*

**22558** **(CONF-8009140—) Carbon dioxide effects research and assessment program: flux of organic carbon by rivers to the oceans.** (National Academy of Sciences - National Research Council, Washington, DC (USA)). Apr 1981. Contract FG01-80EV10335. 403p. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

Separate abstracts were prepared for the 15 papers presented in this workshop report. The state of knowledge about the role of rivers in the transport, storage and oxidation of carbon is the subject of this report. (KRM)

**22559** (CONF-8009140—, pp 5-16) **Storage and transport of carbon by rivers.** Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

Rivers transport impressive amounts of dissolved and particulate material from terrestrial drainage basins to the oceans, but the exact quantity remains elusive. Rivers also contain an extensive and diverse biota on their floodplains and in their waters. A large river tends to integrate the biogeochemical activities within the drainage basin. Thus, the amount and composition of organic carbon at any one site in a river is dependent on both in situ activities and events in the watershed. Qualitative and quantitative changes in the load of organic matter are brought about by specialized biological communities and physical retention processes throughout the drainage basin. Not all organic carbon that enters a river is processed immediately or exported. Some is stored in river sediments.

**22560** (CONF-8009140—, pp 16-23) **Role of river-transported organic carbon in the global cycle.** Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

Organic carbon produced and eroded from uplands is transported by streams to lowland areas, and in these areas of alluvial and colluvial deposition, organic carbon is respired and decayed and returned to the atmosphere as $CO_2$. Additional carbon is also added to waters in their transit from upland to lowland regions by photosynthesis in stream channels, flood plains, and other areas. In the lowlands much of the organic carbon is oxidized (respired); a small part of the remainder accumulates in alluvial and colluvial sediments and a larger part is carried by low order streams toward the ocean. The average annual net export of carbon from land to the marine environment ($66 \times 10^{12}$ moles) is a result of the complex balance between storage, release, and respiration (oxidation) of organic carbon in terrestrial and aquatic environments.

**22561** (CONF-8009140—, pp 34-45) **Rate of denudation in Black Sea source area.** Degens, E.T. (Univ. of Hamburg, Germany). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

At present, the Black Sea is a gigantic catch basin for the river discharge of half of Europe and part of Asia. The source area is well defined and can be subdivided into several orographic provinces which are distinguished by geography extension, climate, and elevation. The region under study is characterized by its diversity. The issue is further complicated, because the Pripjet swamps, the Panonic flatland, and the lowlands along the Black Sea coast are regions of sedimentation rather than denudation.

**22562** (CONF-8009140—, pp 75-108) **Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries.** Spiker, E.C. (Geological Survey, Reston, VA). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

The riverine flux of carbon may be serving as an effective short-term sink for anthropogenic $CO_2$ if this carbon flux is increasing in response to human activities, and if this carbon is ultimately sequestered in sediments for several tens to hundreds of years. The source of this is of primary importance. Before an estimate can be made of the relative importance of the riverine carbon flux, the sources, sinks, and rates of biochemical processing in river-estuarine systems need to be determined. This paper discusses the application of carbon isotopes ($^{14}C/^{13}C/^{12}C$) to these studies. The double isotopic labelling of carbon is particularly useful for the analysis of sources and sinks of carbon.

**22563** (CONF-8009140—, pp 109-141) **Chemical indicators of organic river sources in rivers and estuaries.** Hedges, J.I. (Univ. of Washington, Seattle). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

Almost all molecular tracers used to distinguish the geographic or biological sources of organic matter in natural environments are derived from photosynthetic plants. This selectivity results from the fact that photosynthetic plants are the ultimate carbon source and typically the major biomass constituent. Animals are usually of minor quantitative importance, and are composed primarily of proteins that are compositionally similar at the molecular level. Lower plants, such as fungi, bacteria, and phytoplankton are ubiquitous, while higher (vascular) plants are confined almost exclusively to land. Almost all distinction between marine- and land-derived organic matter currently made at the molecular level are accomplished, in fact, by identifying biochemicals characteristic of higher land plants. Molecular organic indicators can be classified in terms of the four major categories of plant natural products: carbohydrates, proteins, phenolics (primarily lignins), and lipids.

**22564** (CONF-8009140—, pp 142-172) **Deposition of riverborne organic carbon in floodplain wetlands and deltas.** Mulholland, P.J. (Oak Ridge National Lab., TN). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

In this paper an assessment of the deposition of riverborne organic carbon in floodplain wetlands and river deltas is presented. Few studies have addressed carbon deposition in these types of systems, although they appear to possess high rates of sediment and organic carbon accumulation. These systems may be important globally as sinks for carbon fixed during photosynthesis by upland vegetation.

**22565** (CONF-8009140—, pp 173-218) **Flux of organic carbon to the oceans: some hydrologic considerations.** Nordin, C.F. Jr.; Meade, R.H. (Geological Survey, Denver, CO). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

Estimates of the flux of organic carbon to the oceans vary by at least an order of magnitude, and to some extent they are based on assumptions that either are difficult to verify or are contradicted by existing data. The usual approach for estimating the contribution to the ocean from rivers is to measure or otherwise estimate the flux from the largest rivers, the 40 or 50 that contribute about half the total flow and drain about 60% of the land area, and then to extrapolate the rest. The same approach can be used to estimate flux of organic carbon. In making estimates from such an approach, however, one must consider certain hydrologic processes. In addition, it is desirable to collect the kinds of data that will allow one to evaluate the impact of extreme events on the average values of annual flows or fluxes, and that are required to arrive at reasonable figures for determining standard errors of estimates.

**22566** (CONF-8009140—, pp 219-269) **River transport of organic carbon to the ocean.** Meybeck, M. (Ecole Normale Superieure Lab. de Geologie, Paris, France). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

The purpose of this paper is to review the existing data on dissolved, particulate, and total carbon (DOC, POC, and TOC) in rivers, to study their variation with time and space, and to extrapolate these data to the global input of organic carbon from rivers to oceans.

**22567** (CONF-8009140—, pp 270-293) **Fluxes of organic matter in rivers relative to the global carbon cycle.** Richey, J.E. (Univ. of Washington, Seattle). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

The purpose of this workshop is to examine the role of rivers in the global carbon cycle. The intent of this contribution is to provide a framework for the workshop by reviewing the biogeochemistry of carbon in rivers, and to evaluate carbon fluxes for a specific river, the Amazon. Finally existing estimates and assumptions on river carbon transport will be reviewed.

**22568** (CONF-8009140—, pp 294-313) **Fate of sedimented organic carbon in estuaries.** Wangersky, P.J. (Dalhousie Univ., Halifax, Nova Scotia). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

The fate of organic matter after sedimentation in the estuaries is discussed. The mechanisms involved in storage and remineralization in these sediments are considered. The overriding consideration in any estimate of the fate of sedimentary organic matter must be the input of turbulent energy into the estuary. Resuspension of sediments is the quickest route to recycling of the organic materials. Estimates of the normal or average amount of turbulence in any area of an estuary can be derived from rates of sedimentation.

**22569** (CONF-8009140—, pp 314-330) **Radiocarbon in New York Bight sediments and the use of carbon isotopes in delineating carbon sources.** Turekian, K.K.; Benoit, G.J. (Yale Univ., New Haven, CT). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

Organic carbon in contemporary nearshore sediments is derived from both natural and artificial sources. The quest for identi-

fying these various sources has led to the search for diagnostic chemical, physical, or isotopic properties of the different components. One promising property is the carbon isotope imprint. Marine-derived organic carbon and terrestrial carbon are the most obvious natural sources. The distinction between these two sources in sediments has been discerned on the basis of $\delta^{13}C$ values. The artificial sources are oil and coal products and sewage sludge. These sources have $\delta^{13}C$ values close to terrestrial carbon. Thus, by using $\delta^{13}C$ it may be possible, in temperate zones, to distinguish an open-ocean plankton source of sedimentary carbon from all other sources.

22570 (CONF-8009140—, pp 331-359) **Fate of terrestrial organic carbon in the coastal area.** Wollast, R.; Billen, G. (Univ. Libre de Bruxelles, Belgium). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

In order to elucidate the behavior of dissolved and particulate organic carbon in shallow coastal areas and more precisely to evaluate how much of the carbon transported to coastal areas by major rivers is either oxidized, stored in sediments or exported to the open ocean, we will first discuss the mechanisms of transfer, production, and removal of organic matter in the estuarine zone. We will then describe the main characteristics of the carbon cycle in the coastal zone and the relative importance of riverborne organic matter in this cycle.

22571 (CONF-8009140—, pp 360-384) **Global carbon cycle: some minor sinks for $CO_2$.** MacKenzie, F.T. (Northwestern Univ., Evanston, IL). Apr 1981. NTIS, PC A18/MF A01.

From Workshop on carbon dioxide effects research and assessment program; Woods Hole, MA, USA (21 Sep 1980).

Since about 1975, it has become evident that sinks other than the ocean and atmosphere may be responsible for storage of some $CO_2$ produced by activities of society. It is not likely that the increased fluxes of carbon associated with these minor sinks are substantial. However, a number of small sinks could play a role in alleviating what seems to be a present small imbalance in the estimates of the carbon cycle. The purpose of this paper is to assess the role of some minor sinks in storage of $CO_2$ produced from fossil fuel burning and other sources.

22572 **(FWS/OBS—80/41) Marine mammals of the Southeastern United States coast and the Gulf of Mexico.** Schmidly, D.J. (Texas A and M Univ., College Station (USA). Dept. of Wildlife and Fisheries Science). Feb 1981. 175p. GPO.

This paper synthesizes all available data and literature about cetaceans and pinnipeds in the region of study. The study area includes the coast and adjacent continental shelf of the United States from Cape Hatteras, North Carolina, to the Florida Keys; and from the Florida Keys to the United States/Mexico boundary near Port Isabel/Brownsville, Texas. This area contains the warmest water in contact with the contiguous United States including the Florida Straits, the southern Gulf Stream, and other important areas. Because of the extreme mobility of marine organisms, the remainder of the Gulf of Mexico, the northern portions of the Caribbean Sea, and the portions of the South Atlantic extending slightly beyond the 1000-fathom isobath (1830 m) have also been included in the survey.

22573 **Survey of ciguatera at Enewetak and Bikini, Marshall Islands, with notes on the systematics and food habits of ciguatoxic fishes.** Randall, J.E. (Bernice P. Bishop Museum, Honolulu, HI). *Fishery Bulletin ;* **78**: No. 2, 201-249(Apr 1980).

A total of 551 specimens of 48 species of potentially ciguatoxic fishes from Enewetak and 256 specimens of 23 species from Bikini, Marshall Islands, were tested for ciguatoxin by feeding liver or liver and viscera from these fishes to mongooses at 10% body weight (except for sharks, when only muscle tissue was used). The fishes are representatives of the following families: Orectolobidae, Carcharhinidae, Dasyatidae, Muraenidae, Holocentridae, Sphyraenidae, Mugilidae, Serranidae, Lutjanidae, Lethrinidae, Carangidae, Scombridae, Labridae, Scaridae, Acanthuridae, and Balistidae. The species selected were all ones for which toxicity can be expected, including the worst offenders from reports of ciguatera throughout Oceania; only moderate to large-sized adults were tested. In all, 37.3% of the fishes from Enewetak and 19.7% from Bikini gave a positive reaction for ciguatoxin. Because liver and other viscera are more toxic than muscle, the percentage of positive reactions at the level which might cause illness in humans eating only the flesh of these fishes collectively would drop to 16.2 for Enewetak and 1.4 for Bikini. This level of toxicity is not regarded as high for Pacific islands, in general. Because ciguatoxin is acquired through feeding, the food habits of these fishes were investigated. Most of the highly toxic species, including seven of the eight causing severe illness or death in the test animals (Lycodontis javanicus, Cephalopholis argus, Epinephelus hoedtii, E. microdon, Plectropomus leopardus, Aprion virescens, and Lutjanus bohar) are primarily piscivorous.

22574 **Early diagenesis in a reducing fjord, Saanich Inlet, British Columbia. I. Chemical and isotopic changes in major components of interstitial water.** Nissenbaum, A.; Presley, B.J.; Kaplan, I.R. (Univ. of California, Los Angeles). Contract AT(04-3)-34. *Geochimica et Cosmochimica Acta ;* **36**: 1007-1027(1979).

Water and interstitial water from the reducing fjord of Saanich Inlet, British Columbia were analyzed for their major element composition, ammonia, phosphate and silica contents, and for stable isotope composition of sulfur and carbon species. Ca was the only major element to show a significant change with depth (a 75 per cent decrease in some cases). Ammonia and phosphate are highly enriched in the interstitial water (IW), concentrations reaching 250 ppM and 39 ppM, respectively. Total dissolved $CO_2$ in IW increases strongly with depth (20 to 30 times that in overlying seawater) and it becomes enriched in $C^{13}$ ($\delta C/\text{sub PDB}/^{13} \approx 17.8\%$). Both sulfate and dissolved sulfide decreased with depth to a complete disappearance of all sulfur species from the interstitial water. The dissolved sulfide is highly enriched in $S^{34}$ ($\delta S^{34} \approx +18\%$). All these changes are attributed to strong biological activity in the sediments.

22575 **pH buffering of pore water of recent anoxic marine sediments.** Ben-Yaakov, S. (Univ. of California, Los Angeles). Contract AT(04-3)-34 P.A. 134. *Limnology and Oceanography ;* **18**: No. 1, 86-94(Jan 1973).

A model is proposed to explain the relative pH stability in pore water of recent anoxic marine sediments. Oceanic data are not inconsistent iwth a model which assumes that the pH of the pore waters is controlled by the byproducts of organic decomposition, sulfate reduction, and precipitation of sulfide and carbonate. The model predicts that the pH of pore waters should remain in the range 6.9 to 8.3, which is in agreement with measured values.

22576 **Interstitial water chemistry, Leg 12.** Presley, B.J.; Petrowski, C.; Kaplan, I.R. (Univ. of California, Los Angeles). pp 891-892 of Initial reports of the Deep Sea Drilling Project. Volume XVI. van Andel, T.H.; Heath, G.R. (eds.). Washington, DC; Government Printing Office (1973).

The interstitial water received at UCLA from Leg 12 consisted of twenty-one 5-millimeter samples intended for analysis of carbon isotope and minor element constituents. No large volume samples for trace element analysis were collected. The samples were obtained at five different drilling sites from sediment dominated by carbonate ooze and glacial-marine clays. All water was forced through a 0.45 membrane filter onboard ship immediately after squeezing. The samples were then sealed in plastic syringes, and were kept refrigerated except for time in shipment. Analysis was started as soon as the samples arrived at UCLA, nevertheless, as much as three months had then elapsed since collection. The analytical procedures currently being used in our pore water program are essentially those described in some detail elsewhere. These procedures have evolved as we have sought to get more and better data from the small samples provided by the Deep Sea Drilling Project. Therefore, the procedures used for Leg 12 analyses may, in some instances, be modifications of those described in the references, but any changes are considered not sufficiently significant to warrant a separate description here.

**22577 Interstitial water chemistry: Deep Sea Drilling Project, Leg 10.** Presley, B.J.; Petrowski, C.; Kaplan, I.R. (Univ. of California, Los Angeles). pp 613-614 of Initial reports of the Deep Sea Drilling Project. Volume X. Worzel, J.L.; Bryant, W. (eds.). Washington, DC; Government Printing Office (1973).

Only thirteen pore water samples were received at UCLA from the DSDP Leg 10 operations in the Gulf of Mexico. These had been collected at seven different drilling sites, with only one sample from each of four sites and poor vertical coverage at the others. Such sample coverage does not permit an intelligent interpretation of the data. The 5-ml water samples we received had been forced through a 0.45 micron filter immediately after removal from the sediment and had been stored at 4°C in sealed plastic syringes. Analysis was started as soon as the samples were received, which was as long as three months after collection. The analytical procedures currently being used in our pore water program are essentially those described in some detail elsewhere. These procedures have evolved as we have sought to get more and better data from the small samples provided by the Deep Sea Drilling Project. Therefore, the procedures used for Leg 10 may, in some instances, be modifications of those described in the references, but any changes are not considered sufficiently significant to warrant a separate description here.

**22578 Chemical and isotopic evidence for the in situ origin of marine humic substances.** Nissenbaum, A.; (Weizmann Inst., Rehovot, Israel); Kaplan, I.R. Contract AT(04-3)-34. *Limnology and Oceanography ;* **17**: No. 4, 570-582(Jul 1972).

Humic and fulvic acids were extracted from marine and nonmarine Recent sediments and from soils. These acids are shown to be major components of the organic matter from marine and nonmarine sediments--some marine sediments may contain 70% of their organic carbon in the humic and fulvic acid fraction. Marine and terrestrial humic acids have similar carbon and hydrogen content, but the former generally contain more sulfur and nitrogen. $\delta^{34}S$ values of marine humic acid indicate that the sulfur is introduced into the organic matter as hydrogen sulfide produced by sulfate reduction. Marine humates have a rather constant $\delta^{13}C$ value of -20 to -22%, whereas the $\delta^{13}C$ of soil humic acid is related to its plant source material and usually ranges around -25 to -26%. The evidence shows that marine humic acids can be formed in situ from degradation products of plankton and are not necessarily transported from the continent. The suggested pathway of marine humic acid formation and transformation in the sediment is (1) degraded cellular material→(2) water-soluble complex containing amino acids and carbohydrates→(3) fulvic acids→(4) humic acids→(5) kerogen.

**22579 Interstitial water chemistry: Deep Sea Drilling Project, Leg 11.** Presley, B.J.; Kaplan, I.R. (Univ. of California, Los Angeles). pp 1009-1012 of Initial reports of the Deep Sea Drilling Project. Volume XI. Hollister, C.D.; Ewing, J.I. (eds.). Washington, DC; Government Printing Office (1972).

The interstitial water received at UCLA from Leg 11 (Miami to Hoboken) consisted of fourteen samples of 5 millimeters each intended for carbon isotope and minor constituent work. No large volume samples for trace element work had been received when this report was written. The samples had been collected at six different drilling sites, and from a variety of sediment types.

**22580 Interstitial water chemistry: Deep Sea Drilling Project, Leg 14.** Presley, B.J.; Petrowski, C.; Kaplan, I.R. (Univ. of California, Los Angeles). pp 763-765 of Initial reports of the Deep Sea Drilling Project. Volume XIV. Hayes, D.E.; Pimm, A.C. (eds.). Washington, DC; Government Printing Office (1972).

The interstitial water received at UCLA from Leg 14 (Lisbon, Portugal to San Juan, Puerto Rico) consisted of thirty-one samples of 5 milliliters each intended for carbon isotope and minor element constituents. No large volume samples for trace element analysis were collected. The samples were obtained at six different sites, and from a variety of sediment types.

**22581 Early diagenesis in a reduced fjord, Saanish Inlet, British Columbia. III. Changes in organic constituents of sediment.** Brown, F.S. (TRW Systems Group, Redondo Beach, CA); Baedecker, M.J.; Nissenbaum, A.; Kaplan, I.R. Contract AT(04-3)-34. *Geochimica et Cosmochimica Acta ;* **36**: 1185-1203(1972).

As part of a larger study of diagenesis in the sediment of Saanich Inlet, several groups of organic compounds were isolated from the sediment, identified, their concentration quantitatively determined and where possible, the $C^{13}/C^{12}$ isotope ratio determined. Four 2.5 m cores and one 35 m core were studied. It was found that chlorins show the greatest decrease with depth followed by amino acids and then fatty acids. Aliphatic straight chain hydrocarbons show little change in concentration with depth of sediment, although the aromatic hydrocarbon perylene gave evidence for in situ formation. Fulvic acids, highly abundant at the surface of the sediment, decreased significantly with depth, whereas humic acids did not appear to show any significant change. The amount of insoluble residue increased with depth, constituting the dominant organic carbon form at 17 m and below. There is no strong evidence for significant hydrocarbon formation under mild conditions prevailing, although $C_{16}$ fatty acids appear to be degrading preferentially and may partially convert to the $C_{15}$ paraffin. There is no evidence for in situ formation of isoprenoid hydrocarbons from the phytol side chain of chlorophyll. Pristane and phytane, present in small concentrations at the sediment surface, decrease or disappear with burial. Carbon isotope ($C^{13}/C^{12}$) ratios, were used to determine the relativeamounts of organic matter derived from terrigenous and marine sources. Humic acids appear to form largely from plankton-derived material and not from terrigenous plant or soil sources.

## 5202 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 21615, 22104, 22362, 22551, 22600*

**22582 Biotransformation and fate of chemicals in the aquatic environment.** Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980). 160p. (CONF-7908145—).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

Separate abstracts were prepared for 11 papers presented in these proceedings. The introduction and chapter 8, workshop summary and conclusions, are not included as abstracts. (KRM)

**22583 Water: pesticides in ground water beneath irrigated farmland in Nebraska, August 1978.** Spalding, R.F. (Univ. of Nebraska, Lincoln); Junk, G.A.; Richard, J.J. Contract W-7405-ENG-82. *Pesticides Monitoring Journal ;* **14**: No. 2, 70-73(Sep 1980).

During the 1978 irrigation season, 14 ground water samples were collected in the Central Platte region of Nebraska, an area known to have high nitrate-nitrogen (NO-N) levels, and analyzed for the presence of 13 pesticide residues. Atrazine levels ranged from 0.06 μg/liter to 3.12 μg/liter and were correlated to $NO_3$-N concentrations with a coefficient of $r = +0.55$. Nitrate-nitrogen concentrations were measured as indicators of deep percolation from irrigated lands and ranged from 17.1 mg/liter to 34.3 mg/liter. Alachlor levels ranged from <0.01 μg/liter to 0.71 μg/liter. The amounts of 2,4-D were indeterminate because of experimental problems. Levels of the herbicides silvex and EPTC were below the limits of detectability. Levels of the oragnochlorine insecticides endrin, γ-BHC (lindane), dieldrin, DDT and its primary metabolite DDE, heptachlor and its primary derivative heptachlor epoxide, and methoxychlor were all below the detectable limits of 0.005 and 0.010 μg/liter.

**22584 Critical pathways of polycyclic aromatic hydrocarbons in aquatic environments.** Herbes, S.E.; Southworth, G.R.; Shaeffer, D.L.; Griest, W.H.; Maskarinec, M.P. (Oak Ridge National Lab., TN). pp 113-128 of Scientific basis of toxicity assessment. Witschi, H. (ed.). New York, NY; Elsevier/North-Holland Biomedical Press (1980).

An understanding of the transport processes affecting the persistence and fate of waterborne contaminants is important in

fully assessing their potential hazard to humans. Despite quantitative uncertainties due to lack of sufficient validation data at present, the questions posed at the beginning of the paper may be addressed in summary: PAH may persist for periods of days to weeks in surface waters, while traveling distances of dozens of kilometers from effluent sources. Water turbidity and depth, sunlight intensity, and flow velocity may change predicted half-lives by an order of magnitude or more; PAH are largely present in the dissolved state in clear waters although four- and five-ring compounds may distribute roughly equally between dissolved and particulate forms. The particulate fraction, being less amenable to breakdown by sunlight and nonvolatilizable, is more persistent; PAH may accumulate several thousand-fold in sediments and biota; and photolysis products (and to a lesser extent, microbial transformation products) of PAH are generated in surface waters, and may accumulate if not degraded further. Because some PAH are more persistent than others, the relative composition of a PAH mixture will vary with distances from the source. To determine how the relative composition will vary requires knowledge of the dominant processes acting on PAH in a particular water body.

22585 **Role of biotransformation in environmental hazard assessment.** Lee, G.F.; Jones, R.A. (Colorado State Univ., Fort Collins). pp 8-21 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

In accord with the requirements of the Toxic Substances Control Act, new and expanded-use chemicals must be screened for their potential environmental hazard prior to large-scale manufacture and use. This environmental hazard assessment should have two basic components, environmental toxicology and environmental chemistry-fate. Environmental toxicology considers the concentrations of a chemical and its transformation products which can adversely affect aquatic and terrestrial organisms. Environmental chemistry-fate considers the transport pathways and ultimate disposition of the chemical in the environment and what transformations of the chemical occur and the rates of these transformations. A hazard assessment is made by proceeding through a series of testing levels or tiers which develop information on the toxicology of the chemical and its environmental chemistry-fate until a decision can be made that the environmental risk associated with the manufacture and use of the chemical is acceptable or unacceptable. Considerable work needs to be done to relate the results of laboratory tests for biotransformation rates to the chemical's behavior under various environmental conditions.

22586 **Approaches to estimating microbial degradation of chemical contaminants in freshwater ecosystems.** Johnson, B.T. (Department of the Interior, Columbia, MO). pp 25-33 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

A review of microbial methods for investigating the biodegradability of chemical contaminants revealed omissions in experimental design that tended to negate the usefulness of the methods for estimating the persistency of chemicals in natural environments. Emphasis was on chemical analysis and identification of degradation products and pathways; little consideration was given to the biological part of the degradation test. An integrated approach to the investigation of microbial degradation in aquatic ecosystems is proposed in the hydrosoil biodegradation test. Estimation of the persistency of a xenobiotic in freshwater ecosystems requires consideration of contaminant sorption and concentration, hydrosoil minerals, biogenic and xenobiotic organic content, and microbial activity.

22587 **Material balance approach to estimating aquatic exposure concentrations.** Branson, D.R.; Blau, G.E. (Dow Chemical Co., Midland, MI). pp 53-55 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

Concentrations of chemicals in water lost from process plants can be estimated with the aid of a material balance. During the workshop we presented a material balance case study involving pentachlorophenol. The purpose of the study was to estimate the difference, if any, in environmental hazard between distilled and undistilled pentachlorophenol when used to treat wood via the pressure treatment process. Distillation reduces the level of pentachlorophenol impurities, including chlorinated dioxins, at least tenfold. This brief summary will focus primarily on the key elements of the material balance approach.

22588 **Bioavailability of chemicals in aquatic environments.** Hamelink, J. (Lilly Research Labs., Greenfield, IN). pp 56-62 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

The bioavailability of chemicals in aquatic environments will depend on a number of factors which interact to control the external availability of a chemical to an aquatic organism. This paper addresses those factors influencing the dissolved fraction of chemicals in water and the ways in which a chemical associated with sediments becomes available to aquatic species. Bioavailability is considered as an exchange process whereby a xenobiotic must pass between a boundary layer separating an abiotic medium and the organism. It is shown that the rate of passage through the boundary layer can be approximated by a modification of the evaporative loss equation.

22589 **Role of biodegradation kinetics in predicting environmental fate.** Larson, R.J. (Procter and Gamble Co., Cincinnati, OH). pp 67-86 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

Predictions of environmental concentration are key to assessing the environmental hazard associated with the use of specific organic chemicals. Inherent in the prediction of environmental concentration is the identification and characterization of formation and degradation processes which control the steady-state levels of a chemical. The kinetics of ultimate biodegradation were studied in dilute assay systems typical of soils and surface waters. The rate equation developed to describe biodegradation was found to contain first-order, mixed-order, and zero-order regions, depending on the compound used and the character of the microbial population. In many cases, however, the rate of biodegradation could be approximated by a first-order equation, and extrapolations could be made by using first-order rate constants. The effect of population size and diversity, temperature, and other metabolic variables could be incorporated into biodegradation rate expressions to cover a variety of environmental situations.

22590 **Modeling the environmental fate of synthetic organic chemicals.** Clesceri, L.S. (Rensselaer Polytechnic Inst., Troy, NY). pp 87-98 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

The use of computer-programmed mathematical models can be an effective tool for the prediction of ultimate fate and effects of man-made chemicals in the environment. The conceptual framework for a modeling approach is detailed in this paper. A description is provided of the model, PEST, developed for the prediction of an organic chemical's distribution within a lake ecosystem. The model embodies representations of all important physical, chemical, and biological processes that affect the transport and degradation of synthetic organic chemicals in aquatic environments. It can be used to model several segments of an aquatic system simultaneously with five temporal resolutions.

22591 **Quantitative expression of biotransformation rate.** Baughman, G.L.; Paris, D.F.; Steen, W.C. (Environmental Protection Agency, Athens, GA). pp 105-111 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

Methodologies and approaches to the study of microbial transformation of organic compounds in natural waters and sediments are outlined. Tentative evidence is given to demonstrate that use of rate constants is a reasonable approach. Application of second-order kinetics incorporating the effects of organic compound concentration, bacterial concentration, and sorption by suspended sediment is made to natural systems.

22592 **Nitrilotriacetate: hindsight and gunsight.** Tiedje, J.M. (Michigan State Univ., East Lansing). pp 114-119 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

The environmental history of nitrilotriacetate, a readily biodegradable and high water-soluble replacement builder for detergents, is discussed from both a scientific and a regulatory viewpoint. Nitrilotriacetate data are used as an example demonstrating the need for meaningful predictions of environmental concentrations, for reproducible test methods, and for good extrapolation of laboratory data to actually existing environmental conditions.

22593 **Use of a microcosm approach to assess pesticide biodegradability.** Matsumura, F. (Michigan State Univ., East Lansing). pp 126-135 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

Biodegradation of pesticidal chemicals is not a matter that can be simply measured and expressed, particularly when the term is applied to all the chemical changes which occur in the environment. Changes in the molecular structure of pollutants in the environment are often brought about by many interacting weathering forces, including physical, chemical, and biological factors. The use of properly designed microcosm experiments to examine and predict the significance of these interactions is discussed, and specific research plans, ranging from tests with pure cultures of microorganisms to model ecosystem experiments, are provided.

## 5203 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 21685, 21691, 22552, 22569*

22594 **(IDO—22060) Hydrologic conditions at the Idaho National Engineering Laboratory, Idaho. Emphasis: 1974-1978.** Barraclough, J.T.; Lewis, B.D.; Jensen, R.G. (Geological Survey, Idaho Falls, ID (USA). Water Resources Div.). Apr 1981. 85p. (USGS-OFR—810526). NTIS, PC A05/MF A01.

The Idaho National Engineering Laboratory (INEL) site covers about 890 square miles of the eastern Snake River Plain and overlies the Snake River Plain aquifer. Low concentrations of aqueous chemical and radioactive wastes have been discharged to shallow ponds and to shallow or deep wells on the site since 1952. This report covers the water-level and water-quality data collected by the US Geological Survey during the calendar years 1974 through 1978, and the resulting hydrologic interpretations.

22595 **(ORNL/EIS—192/V2) Uranium in US surface, ground, and domestic waters. Volume 2.** Drury, J.S.; Reynolds, S.; Owen, P.T.; Ross, R.H.; Ensminger, J.T. (Oak Ridge National Lab., TN (USA)). Apr 1981. Contract W-7405-ENG-26. 627p. (EPA—570/9-81-001(Vol.2)). NTIS, PC A99/MF A01.

The report Uranium in US Surface, Ground, and Domestic Waters comprises four volumes. Volumes 2, 3, and 4 contain data characterizing the location, sampling date, type, use, and uranium conentrations of 89,994 individual samples presented in tabular form. The tabular data in volumes 2, 3, and 4 are summarized in volume 1 in narrative form and with maps and histograms.

22596 **(ORNL/EIS—192/V4) Uranium in US surface, ground, and domestic waters.** Drury, J.S.; Reynolds, S.; Owen, P.T.; Ross, R.H.; Ensminger, J.T. (Oak Ridge National Lab., TN (USA)). Apr 1981. Contract W-7405-ENG-26. 574p. (EPA—570/9-81-001(Vol.4)). NTIS, PC A24/MF A01.

The report Uranium in US Surface, Ground, and Domestic Waters comprises four volumes. Volumes 2, 3, and 4 contain data characterizing the location, sampling date, type, use, and uranium concentrations of 89,994 individual samples presented in tabular form. The tabular data in volumes 2, 3, and 4 are summarized in volume 1 in narrative form and with maps and histograms.

22597 **(EPA—570/9-81-001(Vol.1)) Uranium in US surface, ground, and domestic waters.** Drury, J.S.; Reynolds, S.; Owen, P.T.; Ross, R.H.; Ensminger, J.T. (Oak Ridge National Lab., TN (USA)). Apr 1981. Contract W-7405-ENG-26. 345p. (ORNL/EIS—192(Vol.1)). NTIS, PC A15/MF A01.

Published information concerning the concentrations of uranium in 89,994 US surface, ground, and domestic waters is summarized. Sources surveyed included the open literature, state health departments, Federal agencies, and personal contacts. For each state, samples were geographically located, identified by type and use, and tabulated by decreasing uranium concentration. Histograms covering 14 concentration ranges were prepared for all surface, ground, and domestic water samples of each state and for the entire United States. Estimates were made of the population-weighted average concentrations of uranium in domestic waters of each state. Based on these averages, alpha radiation bone doses were computed for lifetime consumptions of each water. In addition, the fractions of water supplies in each state producing water containing uranium in excess of 1, 5, 10, and 20 pCi/L were estimated. An extensive discussion of analytical methods used to determine uranium in surface and ground waters is also included. The concentrations of uranium in 34,561 US surface waters ranged from 0.01 to 582.38 pCi/L and averaged 1.06 pCi/L. The median and modal concentration ranges for these samples were 0.1 to 0.2 pCi/L and 0.2 to 0.5 pCi/L, respectively. In 55,433 US ground water samples the concentrations of uranium ranged from 0.01 to 652.80 pCi/L and averaged 3.18 pCi/L. The median and modal concentration ranges were 0.2 to 0.5 pCi/L and 2 to 5 pCi/L, respectively. Of the listed sample sites 28,239 were identified as domestic water sources. Uranium in these samples ranged from 0.07 to 652.80 pCi/L and averaged 1.73 pCi/L. Using state totals, it is estimated that 15% to 24% of all US water supplies would have uranium concentrations in excess of 1 pCi/L; 4% to 8%, in excess of 5 pCi/L; 0.1% to 3%, in excess of 10 pCi/L; and 0.04% to 1%, in excess of 20 pCi/L.

22598 **Final environmental impact statement. Green River-Hams Fork regional coal.** Denver, CO; Bureau of Land Management (1980). vp. Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0793.

Leasing of 13 tracts of coal in the Green River-Hams Fork region of northwest Colorado and south-central Wyoming is proposed. The preferred alternative, which would include five tracts in Wyoming and eight tracts in Colorado, would involve strip mining of 696.3 million tons of federal coal reserves. Positive Impacts: Leasing would foster the production of 20.3 million tons of coal annually through 1995 and would employ 468 persons from 1985-1986 for mine construction and 1668 persons for mine development from 1987 until closure of mining operations. Two mining towns in the area would experience a significant economic boost, and the coal flow would help meet regional energy needs. Negative Impacts: Mining and ancillary activities would disturb 16,447 acres by 1995, and population increases would result in the disturbance of 728.7 additional acres for housing and infrastructural developments. A total of 38.4 square miles of aquifers would be removed from the

North Platte watershed, and 27.9 square miles would be lost to the Yampa subbasin and the North Platte River watershed. Mixing of aquifers would degrade water quality in deeper aquifers. Thirteen wells and three springs would be severely impacted. Approximately 105,639 acres of big game winter range would be destroyed, removing 3280 deer and 1004 elk from the region. Approximately 1606 acres of riparian habitat would be lost, and several archaeological sites would be impacted. Transportation and social services in the vicinity of the mining operation would experience stress and occasional overloads. Development of 114 oil and gas leases would be delayed, and more than 211,000 animal unit months of forage would be lost through 1995. Nearly 900 acres of rural lands would be converted for urban use.

22599 **Final environmental impact statement. McNary Lock and Dam second powerhouse, Columbia River, Oregon and Washington.** Walla Walla, WA; Corps of Engineers (1979). 568p. Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0801.

Reformulation of the design of a second powerhouse to be constructed at the McNary Lock and Dam project located on the Columbia River in Umatilla County, Oregon, and Benton, Franklin, and Walla Walla counties, Washington, is discussed and implementation of the design is proposed, in a report supplemental to the final environmental impact statement on the construction of the second powerhouse filed in February of 1977.

### 5205 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 21590*

### 5206 Regulations

*REFER ALSO TO CITATION(S) 22582, 22592*

22600 **Role of biodegradability in the environmental evaluation of polychlorinated biphenyls and chemicals in general.** Zitko, V. (Department of Fisheries and Oceans, St. Andrews, New Brunswick). pp 120-125 of Biotransformation and fate of chemicals in the aquatic environment. Maki, A.W.; Dickson, K.L.; Cairns, J. Jr. Washington, DC; American Society for Microbiology (1980).

From Workshop on biotransformation and fate of chemicals in the aquatic environment; Pellston, MI, USA (14 Aug 1979).

A summary of the environmental history of polychlorinated biphenyls is presented, with particular emphasis on the questions of environmental persistence. It is shown that biodegradation tests played a relatively minor role in the detection of environmental problems associated with polychlorinated biphenyls. A discussion of the variable nature of biodegradability tests currently used throughout North America, Europe, and Japan is provided, leading to the suggestion that more attention should be given to the development of realistic, workable schemes conducted within a scientifically sound, efficient, and economical framework.

## 53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

### 5301 Social And Economic Studies

*REFER ALSO TO CITATION(S) 21542, 21667, 21668, 21739, 21892, 22122, 22123*

22601 **Women: the key to a passive solar society.** Redford, L.; Hunt, I.; O'Neill, M.L. (Consumer Action Now, Inc., New York, NY). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society ;* **5.2**: 797-799(1980). (CONF-801016—(Vol.2)). Amherst, MA, USA (19 Oct 1980).

Recognizing the vast untapped potential of women as a force to promote social change, Consumer Action Now (C.A.N.) has developed a National Energy Project for Women designed to encourage women to take an active role in shaping the transition to a society based on conservation, passive solar and all renewable resources. To promote a vision of a passive solar society, traditional patterns of energy use must be broken and conventional thinking changed. Key to the transition is securing the support of women. The National Energy Project for Women is uniquely designed to educate women on energy issues helping them to overcome the feeling of helplessness and to instill the vision of an alternate energy future. The formation of the Stamford Community Pilot Program is described, providing a plan for action that may be applied to other communities. It will focus on how women through their local communities can help to move this country toward reducing its dependence on foreign oil and realizing the enormous potential of passive solar.

### 5302 Assessment Of Energy Technologies

*REFER ALSO TO CITATION(S) 22122, 22141*

22602 **(EMD—81-35) Effects of regulation on the electric utility industry.** (General Accounting Office, Washington, DC (USA)). 2 Mar 1981. 97p. General Accounting Office, Gaithersburg, MD.

Report to Congress by the Comptroller General of the United States.

Many sectors of the electric utility industry have asserted that the industry's financial well being is threatened by over-regulation and that unless some relief is obtained, the industry's ability to continue providing reliable power supplies is threatened. GAO made this review to assess these contentions, determine how increased regulatory activities in the last 10 years have affected utility companies, and identify whereever possible the effects of regulatory requirements on the industry. Even though electric utilities have been subject to stringent regulatory requirements, the total industry has still been able to adequately meet consumer demands. Recent regulatory initiatives reflect an awareness of the need for increased flexibility; however, regulatory and operational problems facing the industry will continue unless agencies having jurisdiction over utilities become more aggressive in redirecting regulatory emphasis and developing greater precision in their efforts.

22603 **Final environmental impact statement. Emery 2 (Hunter 2) Utah Power and Light Company generating station and related transmission facilities.** Washington, DC; Department of Agriculture (1980). 62p. Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0514.

Purchase by the Deseret Generation and Transmission Cooperative of an interest in Utah Power and Light Company's, 430-megawatt (MW) Unit Number 2 (Hunter Station, Unit 2) at the Emery generating complex in Emery County, Utah, is proposed. Positive impacts: Additional power available to the Deseret Cooperative after the purchase would preclude the need for the cooperative to purchase power. Negative impacts: Land displaced by the 1640-acre complex site would include prime farmland and rangeland.

22604 **Final environmental impact statement. Surry Power Station, Unit No. 1 steam generator repair, Virginia Electric and Power Company.** Washington, DC; Nuclear Regulatory Commission (1980). 81p. Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0791.

Repair of deteriorated tubes in the three steam generators of Unit 1 at the Surry Power Station in Virginia is proposed. The cost of the repair project, which would require ceasing operation of the unit for approximately six months, is estimated at $142 million. Positive impacts: By replacing the tubing in unit 1, the project would reestablish full use of the conduits that allow transfer of radioactivity from the primary coolant to the steam system, and the new tubing would reduce tube degradation and emission of radioactive material from the unit. Repair of the system, which is now operating at 76% of its design capacity, would net the applicant $125 million in operational savings. Negative impacts: The storage vault for the replaced lower assembly would displace one acre within the

station site. Workers repairing the tubing would be exposed to 3380 to 5840 man-rems of radioactivity during repair operations.

22605 **Final environmental impact statement. Construction of Pebble Springs Nuclear Plant, Units 1 and 2 (supplement).** Washington, DC; Nuclear Regulatory Commission (1980). 126p. (NUREG—75/025). Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0511.

Issuance of permits to the Portland General Electric Company for construction of the Pebble Springs Nuclear Plant, Units 1 and 2, on an 8400-acre site near the Columbia River in Gilliam County, Oregon, is proposed. The plant would employ two pressurized water reactors to produce up to 3670 megawatts (MW) of thermal power per unit which would drive two steam turbines capable of providing up to 1311 MW of electrical power per unit. Exhaust steam would be cooled by a once-through flow of water pumped from a 1900-acre reservoir. Makeup water would be drawn from the Columbia River at a rate of 45,000 gallons per minute. This supplement to the final environmental impact statement of April 1975 discusses alternative sites for the plant, including the Columbia River, the Willamette River Valley, and the Oregon coast. The Columbia River site would accommodate the units with the least adverse impacts.

22606 **Final environmental impact statement. Alabama Electric Cooperative, purchase of coal property leases.** Washington, DC; Department of Agriculture (1980). 112p. (USDA-REA-EIS(ADM)—79-1-F). Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0792.

Transfer of ownership of coal leases in Lamar, Franklin, Marion, and Winston counties, Alabama, from the Kinlock Coal Company to the Alabama Electric Cooperative, with financial assistance from the Rural Electrification Administration, is proposed. The mines, which would continue to be operated by the Kinlock Company, would lie in the Bear Creek, Wilson Bend, and Hamilton strip mining areas, containing a total of 8.5 million tons of coal reserves. Positive Impacts: Surface mining techniques would extract 400,000 tons of coal annually, 600,000 tons less than is currently taken from the areas by Kinlock. Disturbed acreage would be reclaimed by planting loblolly pine, and the reclamation bond would be $1200 per acre. Coal removed from the reserve areas would assure an adequate, reliable source of fuel for the three coal-fired electric generators at the 515-megawatt Tombigbee Station for a period of 20 years. Negative Impacts: Temporary disruption of land during strip mining would destroy vegetation and mar the landscape on 300 acres annually for a total of 5080 acres over the entire leasing period. Ambient air and water quality at the Tombigbee Station would decline, and shipment of the coal from the mining site to the station would place a burden on the area transportation system.

22607 **Final environmental impact statement. River Bend Nuclear Power Station Unit 1.** Washington, DC; Department of Agriculture (1980). vp. (USDA-REA-EIS(ADM)—80-4-F). Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0790.

Federal financing of an undivided ownership interest of River Bend Nuclear Power Station Unit 2 on a 3292-acre site near St. Francisville, LA, is proposed, in a supplement to the final environmental impact statement of September 1974. The facility would consist of a boiling-water reactor that would produce a maximum of 2894 megawatts (MW) of electrical power. Positive impacts: The unit would help the applicant meet the power needs of rural electric consumers in the region, and the applicant would contribute significantly to area tax base and employment rolls during the life of the unit. Negative Impacts: Construction-related activities would disturb 700 forested acres on the site and 1156 acres along the transmission routes. Of the 60 cubic feet per second (cfs) taken from the river, 48 cfs would evaporate during the cooling process and 12 cfs would return to the river with dissolved solids concentrations increased by 500%. The terrace aquifer would be dewatered for 16 months in order to lower the water table at the building site, and Grants Bayou would be transformed from a lentic to a lotic habitat during this period. Fogging and icing due to evaporation and drift from the cooling towers would increase slightly. During the construction period, farming, hunting, and fishing on the site would be suspended, and the social infrastructure would be stressed due to the influx of a maximum of 2200 workers.

22608 **Final environmental impact statement. Gas Hills Uranium Mill, Union Carbide Corporation, Natrona County, Wyoming.** Washington, DC; Nuclear Regulatory Commission (1980). 234p. (NUREG—0702). Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0789.

Renewal of a source material license for an additional five-year period is proposed to permit continued operation of Union Carbide Corporation's Gas Hills Uranium Project in Natrona and Fremont counties, Wyoming. Tailings would be stored in two mined-out pits approximately 4500 feet southeast of the mill. The remaining lifetime of the mill is estimated to be 10 years. Positive Impacts: Continued operation of the mill would provide ongoing employment and other economic benefits for the region. A supply of uranium oxide would be assured. All areas except the tailings storage sites would be reclaimed after milling operations cease. Negative Impacts: Continued mill operations would sustain current land-use patterns, precluding livestock grazing and the return of wildlife and vegetation on 235 acres. Radioactive emissions from ore excavation and milling would increase the level of radioactivity in the surface environment. Approximately 210 gallons per minute of water would be removed from the Tensleep Formation aquifer, and tailings seepage could degrade the water quality of area aquifers. Continued deposition of fugitive dust would reduce soil productivity, alter vegetation and decrease available wildlife food and cover.

### 5303 Environmental Impact Statements

*REFER ALSO TO CITATION(S) 21590, 22598, 22599, 22603, 22604, 22605, 22606, 22607, 22608*

## 55 BIOMEDICAL SCIENCES, BASIC STUDIES

### 5501 Behavioral Biology

*REFER ALSO TO CITATION(S) 22654, 22721*

22609 **Selection for a red tide organism: physiological responses to the physical environment.** Tyler, M.A.; Seliger, H.H. (Johns Hopkins Univ., Baltimore, MD). Contract DE-AS02-76EVO-3278; DE-AS02-76EVO-3279. *Limnology and Oceanography ;* **26**: No. 2, 310-324(Mar 1981).

The dinoflagellate Prorocentrum mariae-lebouriae has specific physiological characteristics that allow it to participate in a subsurface transport from the southern Chesapeak Bay to the northern bay, where it upwells and forms red tides. A particular growth rate dependence both on temperature and salinity restricts its year-round distribution to the high-salinty southern bay. At summer temperatures, increased tolerance to low salinities allows rapid growth in the low-salinity waters of the northern bay. Positive phototaxis is proposed to act in conjunction with downwelling convergence at a frontal region to form the initial subsurface concentration maximum or lens. Repression of positive phototaxis at a salinity interface appears to prevent the subsurface concentrations from crossing the sharp halocline, retaining the lens population in northward-flowing bottom waters. Prorocentrum increases its pigment concentration and retains its photosynthetic capacity at the extremely low light intensities encountered during the 200-km northward transport. In nutrient-poor surface waters in summer, Prorocentrum migrates at night to the higher nutrient pycnocline region. The winter-spring phasing of the streamflows in both northern and southern bays may be used to predict the degree of Prorocentrum blooming in the northern bay in summer.

**22610 Implications of a partial-differential-equation cohort model.** DeAngelis, D.L.; Mattice, J.S. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Mathematical Biosciences ;* **47**: 271-285(1979).

The growth in size of organisms in a population cohort and the change through time of the number of organisms in the cohort can be modeled in a unified way by means of a partial differential equation. This equation can be solved analytically for reasonable assumptions concerning growth and mortality rates. A cohort will have an initial distribution in sizes both because all offspring are not produced at exactly the same time and because there is some variation in the sizes of organisms at the time of reproduction. Assuming typical organism growth patterns, we show from the solution of the partial differential equation that the size distribution will at first broaden and then eventually become narrow again as the cohort grows in average size. This conclusion is in agreement with growth data on some marine and freshwater organisms. Genetic variations that cause the growth rate to be distributed normally among organisms in the cohort population are also shown to lead to predictable changes in the size distribution through time.

**22611 Theoretical implications of spatial heterogeneity in stream ecosystems.** O'Neill, R.V.; Elwood, J.W.; Hildebrand, S.G. (Oak Ridge National Lab., TN). pp 79-101 of Systems analysis of ecosystems. Innis, G.S.; O'Neill, R.V. (eds.). Fairland, MD; International Co-operative Publishing House (1979).

Our analysis of a simplified conceptualization of the system ecosystem leads to the conclusion that if spiralling (i.e., reutilization of resources released from upstream segments) occurs in stream ecosystems, then the result should be increased standing crops of heterotrophs, and increased resistance and resilience of the total stream system. Similarly, ignoring the spatial heterogeneity which exists within a stream by dealing with averaged values can lead to significant errors in predicting the behavior of this type of ecosystem.

**22612 Natural variability as a source of error in model predictions.** O'Neill, R.V. (Oak Ridge National Lab., TN). pp 23-32 of Systems analysis of ecosystems. Innis, G.S.; O'Neill, R.V. (eds.). Fairland, MD; International Co-operative Publishing House (1979).

Despite natural variability in ecological systems, model parameters are usually considered as constants rather than random variables. By assuming that parameters are distributed according to a triangular distribution, it is possible to gain insight into the bias introduced into model predictions. Calculations are presented for several common functions and discussions focus on factors which lead to significant error in predictions.

## 5502 Biochemistry

*REFER ALSO TO CITATION(S) 21810, 22372, 22573, 22643, 22644, 22648, 22652, 22658, 22661, 22666, 22711, 22717*

**22613 Comparison of $^{13}C$ nuclear magnetic resonance and $^{14}C$ tracer studies of hepatic metabolism.** Cohen, S.M. (Merck Inst. for Therapeutic Research, Rathway, NJ); Rognstad, R.; Shulman, R.G.; Katz, J. *Journal of Biological Chemistry, The ;* **256**: No. 7, 3428-3432(10 Apr 1981).

The gluconeogenic pathway from $^{13}C$-labeled substrates, each of which contained the $^{14}C$-labeled counterpart at a tracer level, has been followed in isolated rat liver cells and in isolated perfused mouse liver. The gluconeogenic flux from glycerol, the synthesis of glycogen, the synthesis of glycogen, the stimulation of glycogenolysis by glucagon, the recycling of triacylglycerol, and an increase in pentose cycle activity under the influence of phenazine methosulfate were all observed directly in the $^{13}C$ NMR spectra of perfused liver or isolated hepatocytes. The relative concentrations of $^{13}C$ label at specific carbons measured by the NMR spectra under these conditions agreed closely with $^{14}C$ isotopic distributions measured in extracts of the same doubly labeled samples for specific activities of $\geq$ 3%. The label distributions measured by both methods were the same to within the experimental errors, which ranged from +-2% to +-7% in these experiments.

**22614 HeLa cell DNA polymerase $\alpha$ is tightly associated with tryptophanyl-tRNA synthetase and diadenosine 5',5'''-P$^1$,P$^4$-tetraphosphate binding activities.** Rapaport, E. (Boston Univ., MA); Zamecnik, P.C.; Baril, E.F. *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 2, 838-842(Feb 1981).

The purified high molecular weight form of HeLa cell DNA polymerase $\alpha$ (deoxynucleosidetriphosphate: DNA deoxynucleotidyltransferase, EC 2.7.7.7) was shown to associate tightly with several aminoacyl-tRNA synthetase activities. Fractionation of the high molecular weight enzyme on hexylagarose followed by gel filtration, chromatography on phosphocellulose, or polyacrylamide gel electrophoresis under nondenaturing conditions demonstrated copurification of only tryptophanyl-tRNA synthetase [L-tryptophan:tRNA/sup Trp/ ligase (AMP-forming), EC 6.1.1.2] along with DNA polymerase $\alpha$. The high molecular weight (660,000) and low molecular weight (145,000) forms of DNA polymerase $\alpha$ were shown to possess a highly specific, noncovalent, diadenosine 5',5'''-P$^1$,P$^4$-tetraphosphate ($Ap_4A$) binding activity. The dissociation constants were determined to be 16 and 22 $\mu$M, respectively, by utilization of a charcoal adsorption procedure. No high-affinity binding of ATP could be detected. These findings suggest a link between the amino acid activation process and DNA replication in mammalian cells.

**22615 Specificity of chemiluminescence in the metabolism of benzo[a]pyrene to its carcinogenic diol epoxide.** Hamman, J.P.; Seliger, H.H.; Posner, G.H. (Johns Hopkins Univ., Baltimore, MD). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 2, 940-942(Feb 1981).

The metabolism of 7,8-dihydroxy-7,8-dihydrobenzo[a]pyrene results primarily in the ultimate carcinogenic metabolite of benzo[a]pyrene, 7,8-dihydroxy-9,10-oxy-7,8,9,10-tetrahydrobenzo[a]pyrene and to a lesser extent 7,8-dihydroxy-9,10-dioxetane-7,8,9,10-tetrahydrobenzo[a]pyrene, from which chemiluminescence is observed. This specific microsomal chemiluminescence has been used to establish that the rate-limiting reaction in the metabolism of benzo[a]pyrene to the bay region diol epoxide is the production of the 7,8-diol. The microsome-mediated chemiluminescence of the parent benzo[a]pyrene is therefore an indicator of the activity of the specific sequence of metabolic reactions leading to the ultimate carcinogenic metabolite.

**22616 Alterations in polyamine levels induced by phorbol diesters and other agents that promote differentiation in human promyelocytic leukemia cells.** Huberman, E.; Weeks, C.; Herrmann, A.; Callaham, M.; Slaga, T. (Oak Ridge National Lab., TN). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 2, 1062-1066(Feb 1981).

Polyamine levels were evaluated in human HL-60 promyelocytic leukemia cells after treatment with inducers of terminal differentiation. Differentiation in these cells was determined by increases in the percentage of morphologically mature cells and in lysozyme activity. Treatment of the HL-60 cells with phorbol 12-myristate-13-acetate (PMA), phorbol 12,13-didecanoate or other inducers of terminal differentiation such as dimethylsulfoxide and retinoic acid resulted in increased levels of putrescine. However, no increase in putrescine could be detected after PMA treatment of a HL-60 cell variant that exhibited a decreased susceptibility to PMA-induced terminal differentiation. Similarly, no increase in putrescine was observed with two nontumor-promoters (phorbol 12,13-diacetate and 4-O-methyl-PMA) or with anthralin, a non-phorbol tumor promoter. In addition to enhancing putrescine levels, PMA also increased the amount of spermidine and decreased the amount of spermine. The increase in putrescine and spermidine preceded the expression of the various differentiation markers. Unlike the changes observed in the polyamine levels after PMA treatment, the activities of ornithine and S-adenosylmethionine decarboxylases, which are polyamine biosynthetic enzymes, did not significantly change. $\alpha$-Methylornithine and $\alpha$-difluoromethylornithine and methylglyoxal bis(guanylhydrazone), which are inhibitors of the polyamine biosynthetic enzymes, did not affect differentiation in control or PMA-treated cells. Because of these observations, we suggest that the change in polyamine levels involve biochemical pathways other

than the known biosynthetic ones. By-products of these pathways may perhaps be the controlling factors involved in the induction of terminal differentiation in the HL-60 and other cell types as well.

**22617 Cell surface modulation of gene expression in brain cells by down regulation of glucocorticoid receptors.** McGinnis, J.F.; de Vellis, J. (Univ. of California, Los Angeles). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 2, 1288-1292(Feb 1981).

The concentration of glycerol-3-phosphate dehydrogenase (GPDH; sn-glycerol-3-phosphate:$NAD^+$ 2-oxidoreductase, EC 1.1.1.8) had previously been determined to be regulated by glucocorticoids in rat brain cells in vivo and in cell culture. We now demonstrate that concanavalin A (Con A) can inhibit the induction of GPDH in a dose-dependent manner in C6 rat glioma cells and in primary cultures of rat brain oligodendrocytes. The inhibition specifically prevents the appearance of new molecules of GPDH, although Con A does not significantly inhibit protein synthesis in these cells, nor does it affect the activity of another solube enzyme, lactate dehydrogenase. The ability to block enzyme induction is not limited to Con A, because other lectins also inhibit induction. The molecular mechanism by which Con A inhibits GPDH induction appears to be by the down regulation of the cytoplasmic glucocorticoid receptors, because exposure to Con A results in the loss of more than 90% of the receptor activity. Con A does not inhibit the receptor assay and no direct interaction between the receptor and Con A could be demonstrated. This down regulation is not tumor cell specific and appears to be a general phenomenon, because it occurs in normal oligodendrocytes and even in normal astrocytes (a cell type in which the gene for GPDH is not expressed). The down regulation of glucocorticoid receptors in normal brain cells suggests two important corollaries. First, it demonstrates the existence of a rate-limiting step controlling the glucocorticoid-dependent gene expression in brain cells and possibly represents a regulatory site common to all glucocorticoid target cells. Second, it suggests that the response to glucocorticoids of oligodendrocytes and astrocytes can be regulated in vivo by cell surface contact with endogenous lectins, neighboring cells, or both.

**22618 High-resolution two-dimensional electrophoretic mapping of human proteins.** Anderson, N.L.; Edwards, J.J.; Giometti, C.S. (Argonne National Lab., IL). Contract W-31-109-ENG-38. pp 313-328 of Electrophoresis '79. Advanced methods, biochemical and clinical applications. Radola, B.J. (ed.). Berlin, Germany; Walter de Gruyter and Co. (1980).

It is now technically feasible to resolve and map two dimensionally a very large fraction of all human protein gene products (monomeric proteins or protein subunits), and to characterize each resolved component in relation to physico-chemical properties, intracellular location, genetics, and function. The organization of the protein portion of the human molecular index is now a matter of active concern. It will ultimately involve organization and classification of proteins into coregulated sets (plus the nonregulated basic set if such exists), into linkage groups depending on the chromosomal localization of the individual genes, and by differentiational groups that characterize differentiating or differentiated cells. A requirement of the index is a sufficient body of descriptive data to distinguish any one protein gene product from all others. Early cancer detection, proper tumor classification, evaluation of therapy, elucidation of mechanisms of action of antitumor agents, and a detailed understanding of how a tumor cell differs from a normal one, all require a complete index.

**22619 Estimation of two-dimensional electrophoretic spot intensities and positions by modeling.** Taylor, J. (Argonne National Lab., IL); Anderson, N.L.; Coulter, B.P.; Scandora, A.E. Jr.; Anderson, N.G. Contract W-31-109-ENG-38. pp 329-339 of Electrophoresis '79. Advanced methods, biochemical and clinical applications. Radola, B.J. (ed.). Berlin, Germany; Walter de Gruyter and Company (1980).

A prototype data reduction system for the processing of two-dimensional electrophoretic gels is being developed at this laboratory. The system includes a Digital Equipment Corporation PDP-11/60 minicomputer and a Floating Point Systems AP-120B array processor. The images are scanned with an Optronics P-1000 high speed drum densitometer, and are displayed using a Grinnell GMR-27 512 x 512 color image display system.

**22620 Internal charge standardization for two-dimensional electrophoresis.** Hickman, B.J.; Anderson, N.L.; Willard, K.E.; Anderson, N.G. (Argonne National Lab., IL). Contract W-31-109-ENG-38. pp 341-350 of Electrophoresis '79. Advanced methods, biochemical and clinical applications. Radola, B.J. (ed.). Berlin, Germany; Walter de Gruyter and Company (1980).

By using current methods of 2-D gel spot intercomparisons, we find ourselves virtually without standardization. However, both carbamylated and fluorescein labeled proteins have been shown to be useful internal standards for isoelectric focusing in polyacrylamide gels.

**22621 Method for studying proteins in 2-D gels using thermal denaturation analysis.** Nance, S.L.; Hickman, B.J.; Anderson, N.L. (Argonne National Lab., IL). Contract W-31-109-ENG-38. pp 351-360 of Electrophoresis '79. Advanced methods, biochemical and clinical applications. Radola, B.J. (ed.). Berlin, Germany; Walter de Gruyter and Company (1980).

Individual proteins are characteristically unfolded and denatured over a specific temperature range which is generally quite small. The thermal denaturation curve may be shifted by altering the environment of the protein, e.g., by adding a substrate or cofactor, changing the pH or salt concentration, etc. By determining the behavior of a protein at a number of different temperatures and in different environments, it is frequently possible to obtain a spectrum of results that is sufficiently distinct from that of other proteins under the same conditions as to be useful as an identifying characteristic. We have employed a stable thermal gradient device to treat multicomponent samples, which were subsequently analyzed for enzymatic activities and by two-dimensional acrylamide gel electrophoresis under denaturing conditions. The results illustrate that this technique can indeed be used to identify proteins in a 2-D gel pattern and to provide information on cofactor or substrate binding.

**22622 Two-dimensional electrophoretic mapping of human erythrocyte proteins.** Edwards, J.J.; Hahn, H.J.; Anderson, N.G. (Argonne National Lab., IL). Contract W-31-109-ENG-38. pp 384-393 of Electrophoresis '79. Advanced methods, biochemical and clinical applications. Radola, B.J. (ed.). Berlin, Germany; Walter de Gruyter and Company (1980).

This paper demonstrates the feasibility of using two-dimensional electrophoresis as an analytical method for mapping both the soluble and the membrane bound proteins of the human erythrocyte. The resolution of these proteins obtained by this method extends the already valuable use of the human erythrocyte as a tool for the study of many metabolic disorders. Furthermore, the use of the ISO-DALT system, with its multisample capability, provides a method for the full utilization of the erythrocyte for genetic screening purposes.

**22623 Two-dimensional electrophoresis of human saliva.** Giometti, C.S.; Anderson, N.G. (Argonne National Lab., IL). Contract W-31-109-ENG-38. pp 395-404 of Electrophoresis '79. Advanced methods, biochemical and clinical applications. Radola, B.J. (ed.). Berlin, Germany; Walter de Gruyter and Company (1980).

This paper shows that two-dimensional electrophoresis can resolve a minimum of 100 protein components from whole saliva and approximately 70 components from parotid saliva compared to the 30 to 40 proteins resolved by one-dimensional electrophoresis techniques. The high resolution of the two-dimensional electrophoresis technique is invaluable for further investigation of salivary proteins such as amylase and for the overall study of salivary proteins as related to oral health and pathology. In addition, the ISO-DALT system opens the way for use of two-dimensional electrophoresis in genetic screening projects and even clinical diagnosis. Saliva is valuable in both efforts as a source of material requiring noninvasive collection methods which contains genetic markers and possibly useful indicators of systematic disorders.

**22624 Two-dimensional electrophoresis of human urinary proteins in health and disease.** Tollaksen, S.L.; Anderson, N.G. (Argonne National Lab., IL). Contract W-31-109-ENG-38. pp 405-414 of Electrophoresis '79. Advanced methods, biochemical and clinical applications. Radola, B.J. (ed.). Berlin, Germany; Walter de Gruyter and Company (1980).

To explore the wider range of diagnostic possibilities inherent in the analysis of urinary proteins, methods are needed for concentration of urinary proteins that prevent selective losses and that minimize protein degradation. In addition, very high resolution analytical methods are required that detect as many constituents as possible. These methods in turn make possible the comparative evaluation of concentration methods. We review briefly here the status of both problems and present some of the results obtained with high-resolution two-dimensional analysis of both normal and pathological urine samples.

**22625 Intestinal transport: studies with isolated epithelial cells.** Kimmich, G.A. (Univ. of Rochester Medical Center, NY). *Environmental Health Perspectives ;* **33**: 37-44(Dec 1979).

Isolated intestinal epithelial cells have been extremely useful for characterizing the nature of intestinal absorption processes and for providing insight into the energetics of $Na^+$-dependent transport systems. This report describes a number of experimental approaches which have been used for investigating the specific epithelial transport systems involved in sugar absorption, but provides information which ultimately should prove useful for characterizing a number of different intestinal transport events. Similar experiments should also prove useful for exploring the effect of environmental agents on the function of intestinal tissue. In the case of sugars, net absorption is accomplished via a mucosal, $Na^+$-dependent concentrative transport system acting in sequence with a passive serosal system which does not require $Na^+$. The serosal system limits the full gradient-forming capability of the muscosal system. Agents such as phloretin or cytochalasin B which inhibit serosal transport allow the cells to establish sugar gradients as high as 70 fold in contrast to 10 to 15 fold gradients observed for control cells. Sevety-fold sugar gradients cannot be explained in terms of the energy available in the electrochemical potential for $Na^+$ if the $Na_2$: sugar coupling stoichiometry is 1:1 as commonly assumed. New information indicates that the true $Na^+$:sugar stoichiometry is in fact 2:1. Flow of two $Na^+$ ions per sugar molecule down the transmembrane electrochemical potential for $Na^+$ provides more than sufficient energy to account for observed 70 fold sugar gradients. If flow of sugar by other routes could be completely inhibited, theoretical sugar gradients as high as 400 could be achieved assuming that the cells maintain a membrane potential of -36 mV as measured for intact tissue.

**22626 Electron transfer reactions in cofacial diporphyrins.** Netzel, T.L. (Brookhaven National Lab., Upton, NY); Kroger, P.; Chang, C.K.; Fujita, I.; Fajer, J. *Chemical Physics Letters ;* **67**: No. 2,3, 223-228(15 Nov 1979).

Optical difference spectra consonant with electron transfer from a magnesium porphyrin to a free base porphyrin are obtained following picosecond excitation of cofacial diporphyrins covalently linked approximately 4 A apart. The charge-transfer species decays with a lifetime of 620 +- 20 ps. 17 references, 4 figures, 1 table.

**22627 Anionic detergents as divalent cation ionophores across black lipid membranes.** Abramson, J.J.; Shamoo, A.E. (Univ. of Rochester School of Medicine and Dentistry, NY). *Journal of Membrane Biology ;* **50**: 241-255(1979).

Three ionic detergents commonly used in membrane-bound protein isolation and reconstitution experiments, SDS, cholate, and DOC, are shown to act as divalent cation ionophores when incorporated into black lipid membranes made from either oxidized cholesterol or a mixture of phosphatidylcholine and cholesterol. At a concentration greater than or equal to 1 $\mu$m, SDS shows large selectivity differences between cations and anions and among the different cations tested. Deoxycholate and cholate at concentrations greater than $4 \times 10^{-4}$ m and $10^{-3}$ m, respectively, also act as divalent cation ionophores. The selectivity sequences measured for these two detergents is evidence for a strong ionic interaction between the divalent cation and the anionic charged groups on the detergent. In the case of cholate, the conductance depends on the third or fourth power of the cholate concentration and shows a linear dependence on $CaCl_2$ concentration. The conductance for deoxycholate depends on the sixth or seventh power of the DOC concentration and is also linearly dependent on the $CaCl_2$ concentration. In an oxidized cholesterol black lipid membrane in the presence of 5 mm $CaCl_2$, small concentrations of $LaCl_3$ inhibit the ionophoric activity of each of the detergents tested. Evidence is presented to show that this inhibitory effect is a nonspecific effect on oxidized cholesterol BLM's, and is not due to a direct effect of $La^{3+}$ on detergent-mediated transport.

**22628 Critical examination of the salicylaldehyde method for the determination of primary amines in the presence of secondary amines.** Selig, W. (Univ. of California, Livermore). Contract W-7405-ENG-48. *Fresnius' Zeitschrift fuer Analytische Chemie ;* **296**: 396-399(1979).

The salicylaldehyde method for the differentiation of primary and secondary amines in mixtures has been critically evaluated. This method yields best results in acetonitrile. In mixtures of amines one can expect high results for the primary amine with correspondingly low results for the secondary amine. Corrections can be made with known mixtures of the amines.

**22629 Redox titration of electron acceptor Q and the plastoquinone pool in Photosystem II.** Golbeck, J.H.; Kok, B. (Martin Marietta Labs., Baltimore, MD). Contract EY-76-C-02-3326-A001. *Biochimica et Biophysica Acta ;* **547**: 347-360(1979).

The primary photochemical quencher Q and the secondary electron acceptor pool in Photosystem II have been titrated. We used particles of Scenedesmus mutant No. 8 that lack System I and allowed the system to equilibrate with external redox mediators in darkness prior to measurement of the fluorescence rise curve. The titration of Q, as indicated by the dark level of F/sub i/, occurs in two discrete steps. The high-potential component (Q/sub h/) has a midpoint potential of +68mV (pH 7.2) and accounts for ~ 67% of Q. The pH sensitivity of the midpoint potential is -60 mV, indicating the involvement of 1 $H^+$/e. The low-potential component ($Q_1$) accounts for the remaining 33% of Q and shows a midpoint potential near -300 mV (pH 7.2). The plastoquinone pool, assayed as the half-time of the fluorescence rise curve, titrates as a single component with a midpoint potential 30 to 40 mV more oxidizing than that of Q/sub h/, i.e., at 106 mV (pH 7.2). The E/sub m/ shows a pH sensitivity of -60 mV/pH unit, indicating the involvement of 1 $H^+$/e. The observation that all 12 to 14 electron equivalents in the pool titrate as a single component indicates that the heterogeneity otherwise observed in the secondary acceptor system is a kinetic rather than a thermodynamic property. Illumination causes peculiar, and as yet unclarified, changes of both Q and the secondary pool under anaerobic conditions that are reversed by oxygen.

## 5503 Cytology

*REFER ALSO TO CITATION(S) 22616, 22618, 22622, 22625, 22627, 22629, 22643, 22644, 22646, 22650, 22653, 22666, 22711*

**22630 (CONF-8005164—1) Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density.** Mullaney, P.F.; Mann, R.; Seger, G.; Achatz, M. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.); Los Alamos Scientific Lab., NM (USA); Oak Ridge National Lab., TN (USA); Mainz Univ. (Germany, F.R.). Zoology Dept.). 1981. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01.

From 3. international conference on automation of diagnostic cytology and cell image analysis; Munich, F.R. Germany (23 May 1980).

High resolution fluorescent image analysis has been conducted with mithramycin stained cells from clinical gynecological specimens. Features characteristic of the usual, low resolution, one dimensional slit-scan flow cytometric measurements were extracted from 250 high resolution nuclear images. In addition to the measurement of the usual parameters, nuclear ellipticity and DNA density (DNA per unit nuclear size) were also determined. Preliminary

results indicate both these features offer increased discrimination. When nuclear shape is included as a global feature, at least 77% of the diagnostic cells can be distinguished from normals, with no overlap. Both features hold promise for improving the discrimination possible with flow cytometry.

**22631 (UR—3490/LCP-22) Analysis of cells isolated from bone cultured on collagen gels and polystyrene culture dishes.** Fletcher, K. (Rochester Univ., NY (USA). Dept. of Radiation Biology and Biophysics). 1981. Contract AC02-76EV03490. 225p. NTIS, PC A10/MF A01.

Bone is a complex tissue which contains three types of differentiated cells viz., osteoblasts, osteoclasts and osteocytes. In mature bone, these cells are identified both by their location within the tissue and their morphological characteristics. In fetal tissue, one also finds many progenitor cells, fibroblasts and some cartilage cells. Each of these cell types has distinct functions which are reflected in their morphology, metabolic properties and response to hormones. Studies were also undertaken to evaluate the class of problems associated with electron microprobe analysis of the extracellular fluid space in bone. It was determined that differences in elemental composition in a small volume between cells and mineral cannot be quantitatively corrected for fluorescence, atomic number or absorption effects of the mineral. A study of the use of free-flow dialysis in the study of metal binding to protein demonstrates the anomalous behavior of mercury in this experimental approach and emphasizes the importance of a thorough examination of the control situation before protein to metal binding is examined.

**22632 Variants of 3T3 cells lacking mitogenic response to the tumor promoter tetradecanoyl-phorbol-acetate.** Butler-Gralla, E.; Herschman, H.R. (Univ. of California, Los Angeles). Contract AM03-76-SF00012. *Journal of Cellular Physiology ;* **107**: No. 1, 59-67(Apr 1981).

The potent tumor promoter 12-0-tetradecanoyl-phorbol-13-acetate (TPA) can stimulate quiescent, nonproliferating 3T3 cells to reenter the cell cycle and divide. We have previously used a selection technique developed in our laboratory to isolate variant cell lines which no longer divide in response to epidermal growth factor. We have now utilized the same selection procedure to isolate, from 3T3 cells, two variant cell lines, TNR-2 and TNR-9, which retain growth control and divide in response to elevated serum or fibroblast growth factor, but which do not respond to TPA. The variants do not incorporate precursors into DNA in response to TPA, demonstrating that the cells do not enter the S phase of the cell cycle. The TPA nonresponsive variant TNR-2 cannot respond to epidermal growth factor; TNR-9 responds to this mitogen. TNR-2 variant cells, which do not respond to EGF, do not bind $^{125}$I-EGF.

**22633 Applications of image intensification to low level fluorescence studies of living cells.** Reynolds, G.T. (Princeton Univ., NJ). Contract EY-76-S-02-3120. *Microscopica Acta ;* **83**: No. 1, 55-62(Mar 1980).

Microscopic observations of weak fluorescence from living cells can be achieved by using image intensification techniques in situations where conventional film recording is not feasible. A brief description is given of experimental arrangements that have been used, involving recording the intensifier output alternately on film, or TV vidicons. References are given to more detailed descriptions of particular systems, and an example is presented of the detection of $Ca^{++}$ in Haemanthus by means of the fluorescence of chlorotetracycline.

**22634 Distribution of T and B lymphocytes in blood and lymphoid tissues of fetal and adult sheep.** Chandra, P.; Chanana, A.D.; Joel, D.D. (Brookhaven National Lab., Upton, NY). Contract DE-AC02-76CH00016. *American Journal of Veterinary Research ;* **41**: No. 12, 2092-2094(1980).

Distributions of B and T lymphocytes in blood and various lymphoid tissues of clinically normal adult and fetal sheep were studied. The B and T lymphocytes were identified in enriched preparations of blood lymphocytes and cell suspensions of solid tissues. The T lymphocytes were quantitated by indirect immunofluorescence, using rabbit antisera to sheep thymus cells. The B lymphocytes were identified by direct immunofluorescence, using rabbit antisera to sheep immunoglobulin.

**22635 Scanning electron microscopy of differentiated liver cells transformed in vitro by chemical carcinogens.** Borek, C. (Columbia Univ. Coll. of Physicians and Surgeons, New York, NY). Contract EP-78-S-02-4733. *Journal of Supramolecular Structure ;* **12**: 293-298(1979).

A scanning electron microscopy study was carried out on differentiated liver cells transformed in vitro by three chemical carcinogens into cells that give rise to carcinomas. The results indicate that the transformed cells grow as a rule in tightly adherent monolayers but differ in topography. There is a tendency toward heterogeneity in cell shape compared to the normal and on the whole toward a larger number of surface microvilli in the malignant cell population. However, both in sparse and confluent cultures the topographic differences are often not striking enough to unequivocally distinguish single neoplastic cells from the normal.

**22636 Control of cell proliferation in rabbit lens epithelium.** Harding, C.V.; Harding, D.; Susan, S. (Wayne State Univ., Detroit, MI). Contract EY-76-S-02-2401. *Ophthalmic Research ;* **11**: No. 5-6, 264-275(1979).

Experiments on wound healing in the rabbit lens demonstrate that the lens epithelial cells undergo a configurational change just prior to DNA synthesis. This change could involve alterations in cell-to-substrate and cell-to-cell relationships that play a role in triggering the cell cycle.

## 5504 Genetics

*REFER ALSO TO CITATION(S) 22710, 22714*

**22637 (DOE/EV/02472—T1) Study of mathematical models of mutation and selection in multi-locus systems. Annual progress report, October 1, 1980-September 30, 1981.** Lewontin, R.C. (Harvard Univ., Cambridge, MA (USA). Museum of Comparative Zoology). 1981. Contract AS02-76EV02472. 12p. (COO—2472-07). NTIS, PC A02/MF A01.

During the past year, research has been devoted to two related studies of two-locus systems under natural selection and one on selection in haplo-diploid organisms. The principal results are: (1) Numerical studies were made of 2 locus selection models with asymmetric fitnesses. These were created by perturbing the fitness matrices of symmetric models whose results are known analytically. A complete classification of solved models has been made and all perturbations of these have been undertaken. The result is that all models lead to three classes of equilibrium structure. All are characterized by multiple equilbria with small linkage disequilibria under loose linkage and high complementarity equilibria under tight linkage. In some cases there is gene fixation at intermediate linkage. (2) It has been shown that selection may favor more recombination, contrary to the usual expectation, if multiple locus polymorphisms are maintained by a mechanism other than marginal overdominance. This may be the result of mutation-selection balance or frequency-dependent selection. (3) In a haplo-diploid system in which diploid males are lethal (as in bees and braconid wasps) the number of sex alleles that can be maintained depends both on breeding size and the number of colonies. Simulations show that the steady number is sensitive to the number of colonies but insensitive to the number of matings. Thirty-five to fifty colonies are sufficient to maintain very large numbers of sex alleles.

**22638 Trade-off between r-selection and K-selection in Drosophila populations.** Mueller, L.D.; Ayala, F.J. (Univ. of California, Davis). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 2, 1303-1305(Feb 1981).

Density-dependent genetic evolution was tested in experimental populations of Drosophila melanogaster subject for eight generations to natural selection under high (K-selection) or low (r-selection) population density regimes. The test consisted of determining at high and at low densities the per capita rate of population growth of the selected populations. At high densities, the K-selected populations showed a higher per capita rate of population growth than did the r-selected populations, but the reverse was true at low densities. These results corroborate the predictions derived

from formal models of density-dependent selection. However, no evidence of a trade-off in per capita rate of growth was observed in 25 populations of D. melanogaster, each homozygous for a different second chromosome sampled from a natural population.

**22639 Evidence for nonrandom alterations in a fraction of the highly repetitive DNA of a eukaryote.** Christie, N.T.; Skinner, D.M. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Nucleic Acids Research ;* **8**: No. 2, 279-298(1980).

Although the DNA of the red crab Geryon quinquedens has no patent satellites, a large fraction (~ 40%) is highly repetitive. Treatment of total DNA by Hind III produces fragments comprising 5 to 6% of the genome. While the sizes of some of these fragments form an arithmetic series based on an 81 bp repeating unit, the amounts of the multimers differ significantly from distributions observed for multimeric series in the DNAs of other eukaryotes. In red crab DNA, the amounts of some of the multimers suggest that they may have undergone as much as four times the divergence as the others. Other data, however, are more compatible with the conclusion that there has been selective amplification of segments of highly repeated DNA which results in the enhanced amount of specific multimers. These results indicate the presence of a nonrandom process in the evolution of the highly repetitive DNA. Selective mutation alone seems insufficient to explain these results.

**22640 Electrophoretic variants in three Amerindian tribes: the Baniwa, Kanamari, and central Pano of western Brazil.** Mohrenweiser, H. (Univ. of Michigan, Ann Arbor); Neel, J.V.; Mestriner, M.A.; Salzano, F.M.; Migliazza, E.; Simoes, A.L.; Yoshihara, C.M. Contract EY-76-C-02-2828. *American Journal of Physical Anthropology ;* **50**: No. 2, 237-246(Feb 1979).

Data are presented on electrophoretic variants of 25 polypeptides found in the blood serum and erythrocytes, in 812 individuals from three Amerindian tribes, the Pano, the Baniwa, and the Kanamari. Two private polymorphisms were encountered, of PEPB in the Pano and CAII in the Baniwa, and two possible examples of an unstable variant of HGGB $A_2$ in the Kanamari. These data have recently been incorporated into a treatment which concludes that the eight electrophoretically-defined private polymorphisms thus far encountered in Amerindian tribes can be explained by a mutation pressure of $0.7 \times 10^{-5}$/locus/generation on the assumption of neutrality of the phenotypes in question.

**22641 Familial aggregation of blood pressure and weight in adoptive families: I. Comparisons of blood pressure and weight statistics among families with adopted, natural, or both natural and adopted children.** Annest, J.L. (National Center for Health Statistics, Hyattsville, MD); Sing, C.F.; Biron, P.; Mongeau, J.G. *American Journal of Epidemiology ;* **110**: No. 4, 479-491(1979).

Tests of homogeneity of means, variances and correlations for systolic blood pressure (BP), diastolic BP and weight among subdivisions of a sample of adoptive families are presented. The means and variances of either type of BP, but not weight, were not significantly heterogeneous among families grouped according to the number of parents and children, natural and/or adopted, in the family unit. Estimates of correlation between family members were not heterogeneous among subdivisions for each of the three variables. Our results indicate that these data are suitable for a genetic analysis of familial aggregation. Pooled correlations suggest that the degree of resemblence of BP and of weight between family members varies within and across generations. Correlations involving the adoptees were significantly different from zero only for diastolic BP.

**22642 In vivo conversion of sodium azide to a stable mutagenic metabolite in Salmonella typhimurium.** Owais, W.M.; Kleinhofs, A.; Nilan, R.A. (Washington State Univ., Pullman). Contract EY-76-S-06-2221. *Mutation Research ;* **68**: 15-22(1979).

Salmonella typhimurium TA1530 and G46 strains growing in minimal medium supplemented with sodium azide produce a stable mutagenic metabolite which is not azide. The production of this metabolite is restricted to the log phase of bacteria grown in the presence of azide. The metabolite is highly mutagenic in DNA-repair defective base-substitution strains TA1530 and TA1535, but ineffective in frameshift strains TA1538 and TA1537. The metabolite induces mutations in resting cells of the TA1530 strain.

## 5505 Metabolism

*REFER ALSO TO CITATION(S) 22615, 22642*

**22643 Lymphocyte sodium concentration regulates monovalent cation transport after PHA stimulation.** Segel, G.B.; Lichtman, M.A. (Univ. of Rochester School of Medicine and Dentistry, NY). pp 399-401 of Molecular basis of immune cell function. Kaplan, J.G. (ed.). Amsterdam, Netherlands; Elsevier/North-Holland Biomedical Press (1979).

From 13. international leucocyte culture conference; Ottawa, Ontario, Canada (22 May 1979).

An increase in plasma membrane permability occurs immediately after lymphocytes are treated with PHA or ConA. The increase in permeability causes about a two-fold increase in the rate of diffusion of Na into the cell and of K out of the cell. At the same time, Na and K active transport accelerate. In these studies, we have considered the factors that could sustain an increased rate of Na and K transport after lymphocytes are treated with PHA. It has been suggested that PHA directly stimulates the Na, K-ATPase to increase the transduction of energy that is required for increased transport. This hypothesis does not appear likely since it requires a coordinated effect on both the permeability of the membrane and on the Na, K-ATPase over a range of PHA concentrations. Further we have been unable to demonstrate any direct effect of PHA on Na, K-ATPase activity in purified lymphocyte membrane vesicles; nor could we find an increase in the affinity of the ATPase for its co-factors ATP, Na, or K after PHA treatment. A more plausible hypothesis based on studies in other cells, particularly erythrocytes, would be that an increase in Na concentration sustains the increase in Na and K transport in stimulated lymphocytes. The following studies support the concept that the internal Na concentration plays a central role in the regulation of active Na and K transport in human lymphocytes.

**22644 Total and exchangeable calcium in mitogen-treated lymphocytes.** Lichtman, A.; Segel, G.B.; Lichtman, M.A. (Univ. of Rochester School of Medicine and Dentistry, NY). pp 417-419 of Molecular basis of immune cell function. Kaplan, J.G. (ed.). Amsterdam, Netherlands; Elsevier/North-Holland Biomedical Press (1979).

From 13. international leucocyte culture conference; Ottawa, Ontario, Canada (22 May 1979).

Ca may play a role as an internal signal during the initial events of lymphocyte mitosis. Several reports describe increases in $^{45}Ca$ uptake when lymphocytes are treated with mitogenic lectins, and the Ca ionophore A23187 stimulates lymphocyte DNA synthesis and blastogenesis. However, there are conflicting reports on the magnitude, duration and concentration dependence of ionophore and lectin-induced uptake of $^{45}Ca$. An obstacle in studying mitogen-induced changes in human lymphocyte Ca metabolism has been the difficulty in obtaining accurate measurements of cell Ca in samples prepared with small numbers of cells. Such measurements are required to properly interpret the results of radioisotope experiments. We have used an ultrasensitive graphite furnace atomic absorption spectrophotometer, in conjunction with standard radiolabelling techniques, to measure total cell Ca and cell associated $^{45}Ca$ in lymphocytes exposed to mitogenic concentrations of PHA or A23187.

## 5506 Medicine

**22645** (FDA—81-8042, pp 126-129) **Experiences using B scanning techniques in the dog.** Miller, C.W.; Brewster, R.D.; Stephens, L.C.; Saunders, W.J.; Breuckels, J. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Ultrasonic B scanning techniques are routinely carried out on dogs scheduled for sacrifice. Besides detailing the normal ultra-

sonic appearance of various soft tissues in the abdomen and pelvic areas, two dogs with evidence of disease have been scanned. A tumor of the prostate gland was detected in one dog and tumors affecting both kidneys in another dog were noted ultrasonically. Both of these diagnoses would have required invasive techniques for conventional diagnosis.

22646 **Plastic-embedded human marrow biopsy specimens.** Moosavi, H.; Lichtman, M.A.; Donnelly, J.A.; Churukian, C.J. (Strong Memorial Hospital, Rochester, NY). *Archives of Pathology and Laboratory Medicine ;* **105**: No. 5, 269-273(May 1981).

Improved methods for processing, sectioning, and staining plastic-embedded human marrow biopsy specimens were studied. Special stains, including naphthol AS-D-chloro-acetate esterase, PAS, reticulin, and iron have been modified so that they are suitable for undecalcified, 2-μm-thick, plastic-embedded human marrow biopsy specimens. These adaptations permit plastic-embedded marrow specimens to be used for clinical diagnosis. Marrow biopsy specimens embedded in plastic were compared with biopsy specimens preserved by the conventional paraffin method. The plastic-embedded marrows provide better results from morphologic examination, permit assessment of bone as well as of marrow, and allow histochemical analysis to be performed.

22647 **Energy dispersive x-ray analysis of human lens cataracts.** Harding, C.V.; Susan, S.; Worgul, B.; Solway, A.; Maser, M. (Wayne State Univ., Detroit, MI). Contract EY-76-S-02-2401. *Ophthalmic Research ;* **11**: No. 3-4, 159-163(1979).

Fragments of human cataractous lens were analyzed by energy dispersive x-ray analysis, in combination with scanning electron microscopy. Data which show relatively high phosphorus and low sulfur contents in the intercellular material, as compared to surrounding fiber cell cytoplasm is presented and discussed.

## 5507 Microbiology

*REFER ALSO TO CITATION(S) 21569, 22586, 22710*

22648 **(CONF-810554—1) Novel approach to the growth of anaerobic microorganisms.** Adler, H.I.; Crow, W.D. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01.

From 3. symposium on biotechnology in energy production and conservation; Gatlinburg, TN, USA (12 May 1981).

Previous studies have indicated that a partially purified membrane fraction from Escherichia coli can remove oxygen very efficiently from many bacteriological media. In contrast to the soluble chemical reducing agents frequently used to remove oxygen, membrane fragments are large and cannot penetrate bacterial cells. Furthermore the fragments are more specific in their action and convert oxygen to water by an enzymatic process. These observations suggested that such membranes might provide a novel means of stimulating the growth of anaerobic bacteria. In this contribution, some of the properties of the membrane fraction are described, and the results of a survey of its use with a variety of anaerobic bacteria under several experimental conditions are given.

22649 **Host-pathogen interactions. XV. Fungal glucans which elicit phytoalexin accumulation in soybean also elicit the accumulation of phytoalexins in other plants.** Cline, K.; Wade, M.; Albersheim, P. (Univ. of Colorado, Boulder). Contract EY-76-S-02-1426. *Plant Physiology ;* **62**: 918-921(1978).

A β-glucan isolated from the mycelial walls of Phytophthora megasperma var. sojae and a glucan purified from yeast extract stimulate the accumulation of phytoalexins in red kidney bean, Phaseolus vulgaris, and stimulate the accumulation of the phytoalexin, rishitin, in potato tubers, Solanum tuberosum. Treatment of kidney bean cotyledons with the glucan elicitors resulted in the accumulation of at least five fungistatic compounds. These compounds migrate during thin layer chromatography identically to the fungistatic compounds which accumulate in kidney beans which have been inoculated with Colletotrichum lindemuthianum, a fungal pathogen of kidney beans. Potatoes accumulate as much as 29 micrograms of rishitin per gram fresh weight following exposure to the glucan from Phytophthora megasperma va. sojae and as much as 19.5 micrograms of rishitin per gram fresh weight following exposure to yeast glucan.

22650 **Dependence of herpes simplex virus type 1-induced cell fusion on cell type.** Bzik, D.J.; Person, S. (Pennsylvania State Univ., University Park). *Virology ;* **110**: No. 1, 35-42(15 Apr 1981).

Syncytial mutants of herpes simplex virus type 1 (HSV-1), such as syn20, cause extensive fusion of human embryonic lung (HEL) cells but only a small amount of fusion of human epidermoid carcinoma No. 2 (HEp-2) cells. In order to determine the cellular basis of this difference in fusion, sparse cultures of syn20-infected HEL or HEp-2 cells, previously labeled with [$^3$H]thymidine, were surrounded with uninfected, unlabeled HEL or HEp-2 cells. The fusion of radioactive with nonradioactive cells was determined at different times after infection using radioautography. The major difference in the fusion capacity of HEL and HEp-2 cells was not due to a difference in cell-surface receptors for a fusion factor in the two cell types. The process of infection of HEp-2 cells did not cause the plasma membranes of the cells to become refractory to fusion, because syn20-infected HEL cells fused equally well with either uninfected or infected HEp-2 cells. In a mixed infection with equal numbers of MP and its nonsyncytial parent, mP, extensive fusion was observed for infected HEL cells and significantly less fusion was observed for infected African green monkey (CV-1), baby hamster kidney (BHK-21), and HEp-2 cells.

22651 **Treatment of coal coking and coal gasification wastewaters.** Luthy, R.G. (Carnegie-Mellon Univ., Pittsburgh, PA). *Journal of the Water Pollution Control Federation ;* **53**: No. 3, 325-339(Mar 1981).

From 52. annual conference of the Water Pollution Control Federation; Houston, TX, USA (7 Oct 1979).

This paper summarizes experimental findings on physicochemical pretreatment and biological oxidation of phenolic wastewaters from a coke plant and two pilot high-energy coal gasification processes. Pollutant concentrations in coal coking and phenolic coal gasification effluents were present in different relative proportions with important implications for selection and design of pretreatment processes, and for quality of biologically treated wastewater, including incentive for pretreatment by solvent extraction, relative distribution of free- and fixed-ammonia, and impact of thiocyanate-nitrogen on nitrogen transformations during biological oxidation. Biological treatment of coal refinery effluents results in relatively low microbial yields because of inhibitory constituents in the wastewater or because of compounds formed as a result of biological treatment. In addition, thermodynamic considerations of bacterial utilization of phenol and thiocyanate predict yields somewhat lower would be expected from treatment of less complex wastewaters.

22652 **Early events in herpes simplex virus type 1 infection: photosensitivity of fluorescein isothiocyanate-treated virions.** DeLuca, N.; Bzik, D.; Person, S.; Snipes, W. (Pennsylvania State Univ., University Park). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 2, 912-916(Feb 1981).

Herpes simplex virus type 1 is photosensitized by treatment with fluorescein isothiocyanate (FITC). The inactivation of FITC-treated virions upon subsequent exposure to light is inhibited by the presence of sodium azide, suggesting the involvement of singlet oxygen in the process. Sodium dodecyl sulfate/polyacrylamide gel electrophoresis revealed that treatment with FITC plus light induces crosslinks in viral envelope glycoproteins. Treatment of virions with high concentrations of FITC (50 μg/ml) plus light causes a reduction in the adsorption of the virus to monolayers of human embryonic lung cells. For lower concentrations of FITC (10 μg/ml) plus light, treated virions adsorb to the host cells, but remain sensitive to light until entry occurs. The loss of light sensitivity coincides with the development of resistance to antibodies. These results are most consistent with a mechanism of entry for herpes simplex virus involving fusion of the viral membrane with the plasma membrane of the host cell.

**22653 Adenovirus type 2 expresses fiber in monkey-human hybrids and reconstructed cells.** Zorn, G.A.; Anderson, C.W. (Brookhaven National Lab., Upton, NY). *Journal of Virology ;* **37**: No. 2, 759-769(Feb 1981).

Adenovirus type 2 protein expression was measured by indirect immunofluorescence in monkey-human hybrids and in cells reconstructed from monkey and human cell karyoplasts and cytoplasts. Monkey-human hybrid clones infected with adenovirus type 2 expressed fiber protein, whereas infected monkey cells alone did not. Hybrids constructed after the parental monkey cells were infected with adenovirus type 2 demonstrated that fiber synthesis in these cells could be rescued by fusion to uninfected human cells. Thus, human cells contain a dominant factor that acts in trans and overcomes the inability of monkey cells to synthesize fiber. These results are consistent with the hypothesis that the block to adenovirus replication in monkey cells involves a nuclear event that prevents the formation of functional mRNA for some late viral proteins including fiber polypeptide.

**22654 Microbial roles in aquatic food webs.** Pomeroy, L.R. Contract AS09-76EV00639. pp 85-109 of Aquatic microbial ecology. Proceedings of American Society for Microbiology conference. Colwell, R.R.; Foster, J.; Ahearn, H.L. (eds.). College Park, MD; University of Maryland (1979).

From American Society for Microbiology conference; Clearwater Beach, FL, USA (7 Feb 1979).

Classical ecological food web theory relegates to bacteria the role of degrading dead and refractory organic materials, an essential but presumably minor role compared to predator-prey and grazer-herbivore processes of macroorganisms. There is growing evidence, however, that bacteria mediate a substantial part of the energy which moves through aquatic food webs. Much nonliving material, in a wide variety of particulate and dissolved forms, is available to be exploited, even in purely pelagic food webs which begin with the production of microscopic plankton. Certainly, any coastal, estuarine, or freshwater system in which macrophytes are dominant producers supports a major flow of energy and materials through microbial pathways. Microbiologists have shown little interest in providing the observational and experimental basis for the major revision of food web theory which seems to be needed. Rapid progress toward a better understanding of food webs is now possible because of recent advances in methods of aquatic microbiology.

**22655 Heterotrophic-photoautotrophic index: a qualitative parameter of microbial interactions applied to a Gulf Stream intrusion.** Campbell, W.B.; Jacobsen, T.R.; Pomeroy, L.R. (Univ. of Georgia, Athens). Contract EY-76-S-09-0639. *Marine Science Communications ;* **5**: No. 6, 383-398(1979).

The relative heterotrophic and photoautotrophic biomass of natural aquatic microbial communities can be assessed by the ratio of total adenylate pools to chlorophyll a. When used in conjunction with active chlorophyll, total adenylate concentrations and adenylate energy charge ratios, it revealed transient responses to short-term intrusions of nutrient-rich Gulf Stream water over the southeastern US continental shelf.

## 5508 Morphology

*REFER ALSO TO CITATION(S) 22658, 22718*

**22656 Prediction of skeletal mass in growing and adult beagles.** Garsd, A.; Goldman, M.; Rosenblatt, L.S. (Univ. of California, Davis). *Growth ;* **45**: No. 1, 29-41(Spr 1981).

A number of equations was developed to predict skeletal mass in living beagles, utilizing data from 92 dogs aged 0-3103 days. Twenty eight independent variables were utilized as predictors. These included sex, age, body weight, four external measurements and 21 measurements taken on eight individual bones. The derived predictive equations were ordered as to complexity, i.e., using minimal to maximal information. Skeletal mass could be best predicted when the beagles were divided into four age groups. The use of criteria other than the adjusted coefficient of determination was helpful in selecting the single best predictive equation from a subset offered by the computer. Average relative predictive errors could be reduced to 4 to 8% with maximal information as compared to 11% or more when only minimal information was available. A single ratio of skeletal to body weight was shown to give poor results when used as the sole criterion for estimating skeletal weight.

**22657 Initial stages of sperm penetration into the egg of Fundulus heteroclitus.** Brummett, A.R.; Dumont, J.N. (Oberlin Coll., OH). Contract W-7405-ENG-26. *Journal of Experimental Zoology ;* **210**: No. 3, 417-434(Dec 1979).

Very little information is available about the morphological details of sperm-egg fusion in teleosts. The acrosomeless teleost sperm gains access to the egg cytoplasm through a small opening (the micropyle) in the egg envelope (the chorion). Identification of the micropyle, therefore, permits one to localize the sperm entry site and to use the electron microscope to study the details of sperm-egg fusion under normal monospermic conditions. In this study freshly stripped eggs of Fundulus heteroclitus were inseminated with sperm of the same species and exposed to fixative at intervals varying from 1 second to 15 minutes after insemination. The scanning electron microscope was used to observe morphological aspects of the initial stages of fertilization.

## 5509 Pathology

*REFER ALSO TO CITATION(S) 22618, 22622, 22624, 22635, 22691*

**22658 Association of myocardial cell necrosis with experimental cardiac hypertrophy.** Revis, N.W.; Cameron, A.J.V. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Journal of Pathology ;* **128**: 193-202(1979).

Cardiac hypertrophy was induced in rabbits by injecting thyroxime or isoprenaline, or by surgically constricting the abdominal aorta. An increase in heart weight was associated with a change in the ratios of bound to free forms of five lysosomal enzymes, a change in serum creatine phosphokinase and lactate dehydrogenase, and a change in the morphology of the myocardial cells. Isoprenaline treatment for 5 days induced a maximal change in heart weight, in the ratio of lysosomal enzymes, and in the serum enzymes. Thyroxine treatment was required for 15 days before maximal changes in heart weight, ratio, and serum enzymes were observed. In contrast, coarctation of the aorta caused a progressive change in heart weight, in the ratio of lysosomal enzymes, and in serum enzymes. These results suggest that necrosis of the myocardial cells does indeed accompany cardiac hypertrophy. It was further observed that autophagosomes, degenerating mitochondria in the myocardial cells during the induction of cardiac hypertrophy, and myofibril lysis were found, all of which confirms the suggestion of myocardial cell necrosis in the experimentally enlarged heart.

**22659 Parasite fauna of the American alligator (Alligator mississippiensis) in South Carolina.** Hazen, T.C.; Aho, J.M.; Murphy, T.M.; Esch, G.W.; Schmidt, G.D. Contract EY-76-S-09-0965. *Journal of Wildlife Diseases ;* **14**: 435-439(Oct 1978).

Twelve American alligators (Alligator mississippiensis) were obtained from three different areas of South Carolina. One species of pentastome (Sebekia oxycephala), two species of nematodes (Dujardinascaris waltoni and Multicaecum tenuicolle), four species of trematodes (Polycotyle ornata, Acanthostomum coronarium, Archaeodiplostomum acetabulatum and Pseudocrocodilicola americaniense) and one species of hemogregarine (Haemogregarina crocodilnorum) were recovered. Polycotyle ornata was observed only in alligators from Par Pond while P. americaniense was found in Par Pond and coastal hosts, A. acetabulatum from Kiawah island and coastal alligators, and A. coronarium only at Kiawah Island. These patterns suggest disjunct distributions for the trematode species in South Carolina alligators. The other parasites were found in alligators from all three locations. The only parasite observed to initiate damage or lesions in the alligator was the pentastome.

## 5510 Physiological Systems

*REFER ALSO TO CITATION(S) 22613, 22623, 22640, 22656, 22657, 22687, 22693, 22709, 22712, 22716*

**22660 (PNL-SA—9197) Bioindicators of the health of arctic foxes.** Penman, J.A.; Garrott, R.A.; Eberhardt, L.E.; Anthony, A.; Rothenbacher, H.; Storm, G.L.; Tzilkowski, W.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 30 Dec 1980. Contract AC06-76RL01830. 29p. (CONF-8008103—1). NTIS, PC A03/MF A01.

From Worldwide furbearer conference; Frostberg, MD, USA (3 Aug 1980).

Analyses were made of blood chemistry profiles and liver cytochemical components (ribonucleic acid, protein and glycogen) of captive arctic foxes (Alopex lagopus) maintained on either a protein-sufficient or deficient diet. Protein-deficient foxes exhibited a marked decrease in serum urea nitrogen (UN) levels and in hepatocyte ribonucleic acid (RNA) and protein contents. Comparison of blood profiles between free-ranging and pre-treatment captive foxes yielded several differences. A number of blood components, notably those used as tests of liver function, were negatively correlated with hepatocyte RNA levels. Results support the utility of using both blood chemical and tissue histochemical analyses to ascertain the health of animals.

**22661 Phycobilisome-thylakoid topography on photosynthetically active vesicles of Porphyridium cruentum.** Dilworth, M.F.; Gantt, E. (Smithsonian Institution, Rockville, MD). Contract EY-76-S-05-4310. *Plant Physiology ;* **67**: No. 4, 608-612(Apr 1981).

Conditions are described for isolating functional phycobilisome-thylakoid vesicles from the red alga Porphyridium cruentum. They required ferricyanide as an oxidant and had $O_2$ evolution rates higher than whole cells. Energy transfer to photosystem II chlorophyll was evident from a high F695 nanometer (-196 C) emission peak. In electron micrographs of negatively stained material, the active thylakoid vesicles were found covered by closely spaced phycobilisomes on their external surface. The phycobilisome number in negatively stained vesicles was 450 per square micrometer, which was in the same range as the 400 per square micrometer observed in surface sections.

**22662 Osmoregulation in the Avena coleoptile in relation to auxin and growth.** Stevenson, T.T.; Cleland, R.E. (Univ. of Washington, Seattle). Contract AM06-76RLO2225. *Plant Physiology ;* **67**: No. 4, 749-753(Apr 1981).

A study has been made of the effects of auxin and growth on the ability of Avena coleoptile sections to osmoregulate, i.e., to take up solutes so as to maintain their osmotic concentration, turgor pressure, and growth rate. The high auxin-induced growth rate of Avena coleoptiles is maintained when cells are provided sucrose, glucose, NaCl, or KCl as a source of absorbable solutes, but not when 2-deoxy-O-glucose or 3-O-methyl-O-glucose is used. In the absence of auxin, cells take up solutes from a 2% sucrose solution and the osmotic concentration increases. Solute uptake is not stimulated by auxin when growth is inhibited osmotically or by calcium ions. Solute uptake appears to have two components: a basal rate, independent of auxin or growth, and an additional uptake which is proportional to growth. Osmoregulation of sections may be limited by the rate of entry of solutes into the tissue rather than by their rate of uptake into the cells.

**22663 Action of protein synthesis inhibitors in blocking electrogenic $H^+$ efflux from corn roots.** Chastain, C.J.; LaFayette, P.R.; Hanson, J.B. (Univ. of Illinois, Urbana). Contract AC02-76EV00790. *Plant Physiology ;* **67**: No. 4, 832-835(Apr 1981).

The block in the electrogenic $H^+$ efflux produced by protein synthesis inhibitors in corn root tissue can be released or by-passed by addition of fusicoccin or nigericin. The inhibition also lowers cell potential, and the release repolarizes. Associated with the inhibition of $H^+$ efflux is inhibition of $K^+$ influx and the growth of the root tip; fusicoccin partially relieves these inhibitions, but nigericin does not. The inhibition of $H^+$ efflux which arises from blocking the proton channel of the ATPase by oligomycin or N,N′-dicyclohexylcarbodiimide can also be partially relieved by fusicoccin, but not by nigericin; the inhibition produced by diethylstilbestrol is not relieved by fusicoccin. The results are discussed in terms of the presumed mode of action of fusicoccin on the plasmalemma ATPase.

**22664 Electrical image deposition of charges from laminar flow in cylinders.** Becker, R.S.; Anderson, V.E.; Allen, J.D. Jr.; Birkhoff, R.D.; Ferrell, T.L. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Journal of Aerosol Science ;* **11**: 461-466(1980).

The electrical force on a point charge in a conducting cylindrical channel is calculated exactly and compared with approximations used in the literature. The exact form is shown to lead to larger deposition rates for charges in a laminar flow in a viscous medium. Several numerical applications are presented.

**22665 Temporal modulation sensitivity of macaque monkeys.** Merigan, W.H. (Univ. of Rochester, NY). *Vision Research ;* **20**: 953-959(1980).

Temporal modulation sensitivity functions were measured at three adaptation levels for four macaque and two human observers. The high luminance modulation transfer functions peaked at 10 to 20 Hz for all subjects, and showed attenuated sensitivity at higher and lower frequencies. Functions measured at lower luminances peaked at lower frequencies and showed a reduced low frequency attenuation. A decrease in the area of the flickering stimulus reduced the modulation sensitivity of both species at middle and high flicker frequencies.

**22666 Mass spectrometric determination of hydroxylamine photooxidation by illuminated chloroplasts.** Radmer, R. (Martin Marietta Labs., Baltimore, MD). Contract EY-76-C-02-3326. *Biochimica et Biophysica Acta ;* **546**: 418-425(1979).

A mass spectrometer with a special inlet was used to directly monitor the products evolved when hydroxylamine-treated chloroplasts were exposed to short saturating light flashes. We found that: (1) molecular dinitrogen was the sole product of hydroxylamine photooxidation, and was formed in an amount equal to twice the $O_2$ evolved during $H_2O$ photooxidation; (2) this reaction was driven by Photosystem II, and did not involve Photosystem I-generated superoxide or peroxide; and (3) in the presence of 3-(3,4-dichlorophenyl)-1,1-dimethyl urea, $N_2$ was evolved only on the first flash. These results suggested that $N_2$ was formed by the combination of two single-electron oxidation products of hydroxylamine.

**22667 Gm allotypes in mother-father-cord trios: a selective transfer of autologous, fetal IgG to the mother.** Williams, R.C.; Gershowitz, H. (Univ. of Michigan, Ann Arbor). Contract EY-76-C-02-2828. *Vox Sanguinis. Journal of Blood Transfusion and Immuno-Haematology ;* **37**: 96-102(1979).

When tested at a standard dilution (1:30), mother-cord Gm phenotypes are identical. A more sensitive assay reveals that the fetus does possess paternal antigen, that is, does produce small amounts of autologous IgG. The paternal antigens, in both the mother and the cord plasma, appear in a mosaic, one that suggests the fetus has the ability to selectively transfer his own IgG subclasses to the mother.

**22668 IgG levels in mother-father-cord trios: evidence for a large reduction of maternal IgG at birth.** Williams, R.C.; Gershowitz, H. (Univ. of Michigan, Ann Arbor). Contract EY-76-C-02-2838. *Vox Sanguinis. Journal of Blood Transfusion and Immuno-Haematology ;* **37**: 103-106(1979).

Cord plasmas have a higher concentration of IgG than do the mothers, although autologous, fetal immunoglobulin G is only a small fraction of the neonate's complement. Maternal IgG levels are significantly lower than the nonpregnant adult female, a loss of about one third, which cannot be explained completely by maternal immunization of the fetus.

**22669 Unit membrane redundancy in spherical structures within the ocular lens.** Harding, C.V.; Susan, S.; Jampel, R.S.; Cohn, E. (Wayne State Univ., Detroit, MI). Contract EY-76-S-02-2401. *Ophthalmic Research ;* **10**: No. 1, 7-15(1978).

Spherical structures, found in the nuclear region of some rabbit lenses have been observed with scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Their surface ultrastructure, as seen with SEM, is similar to that of fiber cells normally seen in this region of the lens. However, TEM reveals that multiple unit membranes (2 to 10) make up their surface. Evidence for the possible mode of origin of this membrane redundancy is presented and discussed. Comparisons and contrasts are made with globular structures seen in human cataractous lenses.

### 5520 Public Health

*REFER ALSO TO CITATION(S) 22573*

### 5530 Agriculture And Food Technology

**22670 (DOE/SR/10702—1) Improving tree growth on poor and medium sites through the use of legumes. Annual report, February 14, 1980-September 1, 1980.** Jorgensen, J.R. (Forest Service, Asheville, NC (USA). Southeastern Forest Experiment Station). Aug 1980. Contract AI09-80SR10702. 26p. NTIS, PC A03/MF A01.

Progress is reported on research to improve the productivity of poor land through the use of legumes and limited fertilization. Two sites, a low productivity deep sand and a moderately productive loamy soil were planted to pine, fertilized, and sown to legumes in the winter and spring of 1980. Phosphorus and K were applied to plots of loblolly pine on the loamy soil and to loblolly and Choctawhatchee sand pines on the deep sand. Virgata, sericea, and bicolor lespedezas were sown on disked strips on the deep sand, with Kobe being added on the loam soil. By late July 1980, all legumes were successfully established. Results showed disked strips on the deep sand had nine legume seedlings per .09 $m^2$ area and the loamy soil had 14. Loblolly pine had 75% survival on the loamy soil, and 85% on the deep sand. Sand pine on the deep sand had 82% survival. The difference in survival due to site was significant at the 5% level. Fertilizer and legume treatments had no effect on tree survival.

## 56 BIOMEDICAL SCIENCES, APPLIED STUDIES

### 5601 Radiation Effects

*REFER ALSO TO CITATION(S) 21619, 22510, 22706*

**22671** (CONF-801045—, pp 206-218) **General statistical data structure for epidemiologic studies of DOE workers.** Frome, E.L.; Hudson, D.R. (Oak Ridge Associated Universities, TN). Apr 1981. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

Epidemiologic studies to evaluate the occupational risks associated with employment in the nuclear industry are currently being conducted by the Department of Energy. Data that have potential value in evaluating any long-term health effects of occupational exposure to low levels of radiation are obtained for each individual at a given facility. We propose a general data structure for statistical analysis that is used to define transformations from the data management system into the data analysis system. Statistical methods of interest in epidemiologic studies include contingency table analysis and survival analysis procedures that can be used to evaluate potential associations between occupational radiation exposure and mortality. The purposes of this paper are to discuss (1) the adequacy of this data structure for single- and multiple-facility analysis and (2) the statistical computing problems encountered in dealing with large populations over extended periods of time.

**22672 (DOE/EML—392) Environmental Measurements Laboratory annual report, calendar year 1980.** Volchok, H.L. (Department of Energy, New York (USA). Environmental Measurements Lab.). May 1981. 99p. NTIS, PC A05/MF A01.

The 1980 Annual Report is presented as a series of abstracts, organized by broad programmatic headings under the five technical Laboratory Divisions and one Branch. In addition, a short section appears at the end of the report describing the organization, staff, outside activities and our publications and presentations for the year. Research performaed by the Environmental Studies Division is reported under the following categories: high altitude sampling program, deposition and surface air, and the biosphere. Measurement methods research and air quality field studies are reported by the Aerosol Studies Division. The Radiation Physics Division reported research on radiation transport theory, radiation dosimetry, environmental radioactivity, and the assessment of non-nuclear energy technologies. Research in the Analytical Chemistry Division is reported on quality assurance, analytical support of research projects, analytical development for research projects, and programmatic research. The Instrumentation Division reported research on the development of instrumentation in various categories. The Applied Mathematics Branch reported results of programs for aerosol studies, analytical chemistry, environmental studies, and radiation physics. (JGB)

**22673 (DOE/EV/02364—T1) Mechanisms for radiation damage in DNA. Progress report, January 1, 1980-December 31, 1980.** Sevilla, M.D. (Oakland Univ., Rochester, MI (USA)). Sep 1980. Contract AS02-76EV02364. 14p. (COO—2364-18). NTIS, PC A02/MF A01.

In this project several mechanisms are proposed for radiation damage to DNA constituents and DNA, and a series of experiments detailed utilizing electron spin resonance spectrometry to test the proposed mechanisms. Under current investigation are irradiated systems of DNA constituents which may shed light on indirect effects. In addition, studies of radiation effects on lipids have been undertaken which will shed light on the only other proposed site for cell kill, the membrane. Studies completed during the past year are: (1) $\pi$ cations produced in DNA bases by attack of oxidizing radicals; (2) INDO studies of radicals produced in peptides and carboxylic acid model compounds; (3) electron reactions with carboxylic acids, ketones and aldehydes; and (4) $\gamma$-irradiation of esters and triglycerides. Progress has been made this year in a study of radicals generated in model compounds for the sugar-phosphate backbone.

**22674 (FDA—81-8042) CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.** (Bureau of Radiological Health, Rockville, MD (USA)). Jan 1981. 172p. GPO.

Highlights of findings by the Collaborative Radiological Health Laboratory (CRHL) on lifetime hazards associated with prenatal and early postnatal exposure to discrete doses of gamma radiation are presented in this volume. The CRHL study is designed to provide information that will facilitate the evaluation of risks to human beings from medical exposure during early development. It is a life span study using beagles exposed at one of several specific times in early development. The CRHL program is multidisciplinary in nature and involves evaluation of a variety of diseases of potential concern for human health. Problems of growth and development, reproductive capacity, degenerative diseases, and aging are among those addressed. Separate abstracts of 20 studies have been prepared for inclusion in the Energy Data Base. (RJC)

**22675** (FDA—81-8042, pp 8-11) **Cumulative survival statistics for Segment III beagles of the CRHL Long-Term Study.** Angleton, G.M.; Benjamin, S.A.; Shields, K.A. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Tables for cumulative survival statistics for Segment III beagles of the Collaborative Radiological Health Laboratory (CRHL) Long-Term Study are presented. No effects due to irradiation appear to be manifested in the mortality data through the time when all the dogs are 7 years of age.

**22676** (FDA—81-8042, pp 12-20) **Principal disease or cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development.** Bishop, L.; Kitchen, D.N.; Benjamin, S.A.; Stephens, L.C.; Hargis, A.M.; Lovering, S.L.; Lee, A.C.; Brewster, R.D.; Brooks, R.K. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Epilepsy, hypothyroidism and neoplasia rank as the three leading causes of death in nonsacrifice Segment III beagles. Chronic renal disease is a fourth major disease entity occurring with increasing frequency in the experimental population. These four major diseases accounted for 57% of the deaths in 1979. Of the four leading causes of death, neoplasia alone can be related to the history of radiation exposure.

**22677** (FDA—81-8042, pp 27-39) **Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age.** Stephens, L.C.; Benjamin, S.A.; Hargis, A.M.; Lovering, S.L.; Elie, C.M. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Gross necropsy examinations have been completed on 98 of 111 beagles scheduled for sacrifice at 8 years of age. Neoplasms of the skin, mammary glands, adrenal glands, thyroid glands, and testicles were common findings but the occurrence of neoplasia in these tissues was not correlated with radiation exposure. A variety of nonneoplastic gross pathologic changes have been found, but the only one that has been associated with irradiation has been nodular hyperplasia of the liver. Most tumors removed surgically from these dogs were from the skin and mammary gland.

**22678** (FDA—81-8042, pp 40-44) **Malignancy as a cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development.** Benjamin, S.A.; Kitchen, D.N.; Stephens, L.C.; Bishop, L.; Hargis, A.M.; Lovering, S.L.; Jaenke, R.S.; Lee, A.C.; Brewster, R.D.; Brooks, R.K. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

As of December 31, 1979, 48 Segment III beagles belonging to the 16 or 83 rad dose groups, and which had a malignant neoplasm as the major disease, died or were euthanatized. Thirty-nine of the 48 dogs were irradiated and 20 of the 39 were exposed during the perinatal period. Of these, four died with malignant neoplasms prior to 2 years of age, an unusual occurrence. Twelve irradiated dogs died with malignant lymphomas and five of these dogs were exposed during the perinatal period. These findings suggest that irradiation shortly before or after birth may increase the incidence of cancer early in life and that irradiated dogs may be at risk specifically for development of lymphoid neoplasia.

**22679** (FDA—81-8042, pp 45-55) **Atrophic thyroiditis in long-term Segment III beagles.** Stephens, L.C.; Norrdin, R.W.; Benjamin, S.A.; Brewster, R.D.; Brooks, R.K. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Lymphocytic thyroiditis associated with progressive thyroid atrophy is described in CRHL beagles. Depressed thyroid function was present in many of these dogs, as evidenced by clinical signs of hypothyroidism, elevation of serum cholesterol levels, depressed serum triiodothyronine levels, and alteration of basophils of the antero-medial region and/or unilateral or bilateral obliteration of the thyroid glands by neoplasia. Microscopic changes in the thyroid glands included lymphocytic thyroiditis, thyroid follicular atrophy, adenomatous hyperplasia of follicula cells and C-cells, and follicular cells neoplasia. This disease occurred with no sex predisposition in dogs 2 through 11 years of age. The disease does not appear to be influenced by previous radiation exposure but may be familial. In contrast to thyroid disease in some other beagle colonies, the disease in CRHL beagles more closely resembles atrophic thyroiditis of man rather than human Hashimoto's thyroiditis.

**22680** (FDA—81-8042, pp 56-63) **Thyroid neoplasia in long-term Segment III beagles.** Stephens, L.C.; Benjamin, S.A.; Norrdin, R.W.; Brewster, R.D.; Brooks, R.K. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Seventy-four (4.4%) of the 1680 Segment III beagles had one or more thyroid tumors as of December 31, 1979. Four sacrificed at 5 years of age and 13 sacrificed at 8 years of age had thyroid tumors. Ten malignant thyroid tumors have been removed surgically and 47 other dead dogs with thyroid neoplasms were found. Most tumors were of thyroid follicular cell origin and were near equally divided between benign and malignant varieties. Five dogs had tumors of the parafollicular cells (C-cells). To date, thyroid neoplasia does not appear to be associated with radiation exposure, but there does not appear to be an association with hypothyroidism. Forty-seven (68%) of the 69 dogs with thyroid follicular cell tumors were hypothyroid.

**22681** (FDA—81-8042, pp 64-66) **Malignant lymphomas in beagles exposed to low level radiation.** Benjamin, S.A.; Kitchen, D.N.; Stephens, L.C.; Hargis, A.M.; Lovering, S.L. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Malignant lymphomas are the most common neoplastic disease which has led to the death of Segment III dogs. Twelve dogs have died with lymphomas, all of which were irradiated. Five cases were in dogs in the 16 or 83 rad dose groups exposed at 55 days postcoitus (dpc) and five were in dogs in the 83 rad dose group exposed at 365 days postpartum (dpp). No control dogs have developed lymphoma as of December 31, 1979.

**22682** (FDA—81-8042, pp 67-71) **Cumulative probability of occurrence for ocular lesions in Segment III dogs.** Lee, A.C.; Angleton, G.M. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Estimated cumulative incidence probabilities for retinal atrophy or degeneration, nuclear cataract, and cataract of the central posterior cortex have been calcuated for the CRHL Segment III dogs through 11 years of age. The data reveal the presence of age-related changes and suggest the possibility of increased incidence of some lesions in beagles irradiated at 28 or 55 days postcoitus (dpc) or 2 days postpartum (dpp). Confirmation of this effect will require continued observations and development of specific statistical tests.

**22683** (FDA—81-8042, pp 72-74) **Reduction in eye volume after prenatal or neonatal irradiation.** Lee, A.C.; Angleton, G.M.; Phemister, R.D. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

There is a dose-dependent reduction in eye volume in beagles irradiated with doses of 105 to 355 rads at 28 or 55 days postcoitus (dpc) or 2 days postpartum (dpp). This report presents analyses of the data from Segment III animals killed at 5 and 8 years of age after receiving approximately 83 rads at various developmental ages. Factors having an effect on the eye volume are age-at-sacrifice, sex, femur length (as a measure of body size) and age-at-exposure. There was a significant reduction in eye volume for dogs exposed in the 83 rad dose group at 28 or 55 dpc or 2 dpp.

**22684** (FDA—81-8042, pp 75-79) **Effect of radiation on gestation periods in dams of Segment III beagles.** Angleton, G.M.; Lee, A.C. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

The lengths of the gestation periods for bitches whose offspring were potentially assignable to Segment III of the Long-Term Study were not affected by radiation exposure ($P = .998$). Other factors were found to significantly correlate with the duration of the gestation periods, including the length of the first gestation period ($P < .001$), size of first litter ($P = .175$), the average environmental temperature during pregnancy ($P = .055$) and the size of the second litter ($P < .001$).

**22685** (FDA—81-8042, pp 80-84) **Effect of prenatal irradiation on total litter birth weight.** Angleton, G.M.; Lee, A.C. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Total litter weight at birth was used as a response variable to study the effects of in utero irradiations on birth weight. Analyses were performed in such a manner as to allow for variations in litter size and environmental temperatures. No effects due to irradiation were noted for exposures given 8 days postcoitus (dpc) and 55 dpc. However, for exposures given 28 dpc, a 5% decrement in birth weight was found for an 80 rad dose ($P = .02$).

**22686** (FDA—81-8042, pp 85-89) **Testicular atrophy and neoplasia in Segment III beagles sacrificed at 5 and 8 years of age.** Brewster, R.D.; Stephens, L.C.; Brooks, R.K.; Hargis, A.M.; Benjamin, S.A. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Clinical records of 117 Segment III beagles sacrificed at 5 or 8 years of age were reviewed for evidence of testicular atrophy. Twenty-one percent of the 5-year-old dogs and 36 percent of the 8-year-old dogs had testicular atrophy confirmed by microscopic examination of the testicle sections. Atrophy was recognized in most dogs between 2 and 4 years of age, and at first recognition most were sterile. Twenty-one of the 5- and 8-year-old beagles had testicular tumors. The majority of the tumors were interstitial cell adenomas. No consistent association between radiation exposure, pedigree, or other diseases, such as hypothyroidism, and the development of testicular atrophy, infertility or neoplasms was found.

**22687** (FDA—81-8042, pp 90-94) **Cardiovascular studies in long-term Segment III beagles sacrificed at 8 years of age.** Miller, C.W.; Nealeigh, R.C. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

The cardiovascular system has been evaluated in 107 dogs prior to their sacrifice at 8 years of age. End points studied included arterial wall elastic modulus, pulse wave velocity, peak forward and peak reverse blood flow and average blood flow. These will ultimately be correlated with a variety of echocardiographically measured parameters. While no obvious differences have been seen between control and irradated 8-year-old dogs, testing will continue in older dogs in which cardiovascular diseases are more prominent.

**22688** (FDA—81-8042, pp 95-98) **Incidence of convulsive seizures in Segment III beagles.** Brooks, R.K.; Lee, A.C. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Convulsive seizures are a major cause of death in the Segment III beagles. Evaluation of the clinical records reveal increased incidence with age, a high male-to-female ratio among affected animals and no present evidence for increased incidence due to radiation exposures.

**22689** (FDA—81-8042, pp 100-108) **Radiation effects on brain weight and gonad weight in Segment II beagles.** Norrdin, R.W.; Jaenka, R.S.; Phemister, R.D.; Angleton, G.M. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Data for brain weight and gonad weight in the Segment II beagles were analyzed for radiation effects using the linear model program. A large negative effect on brain weight was found in animals irradiated at 28 days postcoitus (dpc). A lesser effect in young dogs from the 55 dpc and 2 days postpartum (dpp) groups was attributed to the cerebellar hyperplasia and dysplasia present in these perinatally irradiated dogs. A significant negative effect on testis weight was found in the perinatally irradiated groups. No consistent changes in ovary weights were seen.

**22690** (FDA—81-8042, pp 104-110) **Ocular lesions in irradiated beagles.** Benjamin, S.A.; Lee, A.C.; Schweitzer, D.J.; Phemister, R.D. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Both Segment II and Segment III dogs exposed at 28 or 55 days postcoitus (dpc) or at 2 days postpartum (dpp), when the retina is still developing, were evaluated clinically and histopathologically for the presence of retinal lesions. The Segment II dogs received 0 to 355 rads and were sacrificed at 70 days or 2 to 4 years of age. The Segment III experimental groups received 0, 16 or 83 rads and were sacrificed at 5 years of age. Findings in the Segment II irradiated dogs included retinal dysplasia and progressive retinal atrophy accompanied by retinal vascular attenuation. The severity and extent of the lesions increased with dose. The localization of the lesions in the retina was dependent on the age at irradiation, hence, the state of differentiation of the developing retina. No clear evidence of radiation-induced retinal lesions was seen in Segment III dogs sacrificed at 5 years of age.

**22691** (FDA—81-8042, pp 111-116) **Renal alterations in Segment II and III perinatally irradiated beagles.** Jaenke, R.S.; Davis, D.; Norrdin, R.W. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

One of the major radiation-induced effects identified in the CRHL Study has been the development of a serious life-threatening renal syndrome characterized by progressive glomerulosclerosis in perinatally irradiated dogs of the Segment II Study. This syndrome has been studied extensively in the laboratory in order to elucidate its pathogenesis and characteristic morphologic and functional parameters, thus providing the necessary information for appropriate evaluation of Segment III dogs. It has been shown that perinatal irradation causes an immediate interference with postnatal kidney development resulting in a permanent reduction in functional nephrons followed by a delayed, progressive glomerulosclerosis. Recent studies indicate that in at least some dogs receiving doses of 83 rads there is an arrest in nephron maturation and reduction in mature nephron numbers associated with a compensatory renal hypertrophy.

**22692** (FDA—81-8042, pp 117-123) **Case report: study of a beagle with a malignant ectopic thyroid tumor.** Brewster, R.D.; Miller, C.W.; Stephens, L.C.; Jaenke, R.S. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

A Segment III beagle was noted clinically to have cervical edema and muffled heart sounds. Radiographically, masses were found at the base of the heart and throughout the lung field. An electrocardiogram revealed right bundle branch blockage. An echocardiogram demonstrated thickening of the left ventricle and conduction disturbances in the heart which could not be visualized by conventional diagnostic techniques. At necropsy, a neoplasm was found at the base of the heart that had extended into the pulmonary artery, right atria-auricle, interatrial septum, dorsal interventricular septum, and between the pericardium and epicardium over the surface of the right and left ventricles. The location of the tumor masses accounted for the clinical signs and the abnormalities in the electrocardiogram and echocardiogram. Light and electron microscopic examination of the neoplasm at the base of the heart and metastatic neoplasms in the lungs, kidney, and pancreas established a diagnosis of malignant ectopic thyroid tumor.

**22693** (FDA—81-8042, pp 124-125) **Renal function changes associated with aging and ionizing radiation: a summary.** Miller, C.W.; Norrdin, R.W.; Nealeigh, R.C. Jan 1981. GPO.

In CSU-FDA Collaborative Radiological Health Laboratory annual report 1979.

Renal function testing of irradiated and unirradiated beagles at CRHL has been conducted over the past nine years using plasma clearance methods and standard clinical pathology determinations. The Segment II dogs are rapidly declining in numbers, making this portion of the study nearly complete. Many dogs in this group that were irradiated at 55 days postcoitus (dpc) and 2 days postpartum (dpp) showed progressive deterioration in renal function which took place over a 9 to 10 year period. There was considerable variability in the responses of individuals to the radiation insult. Some dogs that had compromised renal function as a consequence of the radiation injury and subsequently had one kidney removed, compensated surprisingly well. Segment III dogs have shown age-relat-

ed changes in renal function but, on the average, no changes in renal function attributed to irradiation have been seen to date. Some individual dogs, however, have shown renal function changes which could be attributed to irradiation in the perinatal period.

22694 **(LBL—12555) Bilogical effects of ionizing radiation: epidemiological surveys and laboratory animal experiments. Implications for risk evaluation and decision processes.** Fabrikant, J.I. (Lawrence Livermore National Lab., CA (USA); California Univ., San Francisco (USA). School of Medicine). Apr 1981. Contract W-7405-ENG-48. 49p. (CONF-801258—1). NTIS, PC A03/MF A01.

From Seminaire des evaluations des risques et processus de decision; Orsay, France (17 Dec 1980).

General background is given for an understanding of the potential health effects in populations exposed to low-level ionizing radiations. The discussion is within the framework of the scientific deliberations and controversies that arose during preparation of the current report of the committee on the biological effects of ionizing radiation of the National Academy of Science - National Research Council (1980 Beir-III Report). (ACR)

22695 **Mortality among men employed between 1943 and 1947 at a uranium-processing plant.** Polednak, A.P.; Frome, E.L. (Oak Ridge Associated Univ., TN). Contract AC05-760R00033. *Journal of Occupational Medicine ;* **23**: No. 3, 169-178(Mar 1981).

Mortality is described in a cohort of 18,869 white males who were employed between 1943 and 1947 at a uranium conversion and enrichment plant in Oak Ridge, Tenn. Workers in certain departments (especially chemical workers) were exposed to high average air levels of uranium dust. Based on deaths reported in 1974 by the Social Security Administration (SSA) and using mortality rates for US white males, standardized mortality ratios (SMRs) for various causes in the entire cohort were generally less than 1.00. After correction for unascertained deaths and missing death certificates, the SMR for lung cancer was 1.22 (95% confidence limits, 1.10 and 1.36). SMRs for various causes, including lung cancer, did not tend to be higher in 8,345 workers employed in areas where uranium dust was present or in 4,008 of these 8,345 workers employed for one year or longer at the plant. Other causes of particular interest (i.e., bone cancer, leukemia, diseases of respiratory and genitourinary systems) did not exhibit high SMRs. The suggestive finding of the authors was an increased number of lung cancer deaths in a group of chemical workers hired at ≧ 45 years of age. Continued follow-up of the cohort is necessary for further evaluation of the long-term health effects of exposure to uranium.

22696 **Irradiation of microorganism such as bacteria and viruses in the presence of chemical enhancing agent.** (to Dept. of Energy). US Patent Application 141,508. 18 Apr 1980. 10p.

This invention relates to a method for disinfecting waste material, such as sewage, containing harmful microorganisms by means of high energy ionizing radiation. This method includes the addition of a chemical enhancing agent such as aluminum chlorde or ferric chloride which would increase the sensitivity of the microorganisms to irradiation. Consequently lower radiation doses would be needed for disinfection.

22697 **Of mice and mutagens.** Krause, C. *Oak Ridge National Laboratory Review ;* **13**: No. 4, 1-14(1980).

Radiation protection and mutagenesis research have been conducted at ORNL since 1947. Surveyed is the research conducted by Bill and Liane Russell. Experiments on laboratory mice were conducted to determine mutagenic effects of radiation. Through these efforts, teratogenic and mutagenic radiation standards have been established.

22698 **Specific sequestering agents for the actinides.** Raymond, K.N.; Smith, W.L.; Weitl, F.L.; Durbin, P.W.; Jones, E.S.; Abu-Dari, K.; Sofen, S.R.; Cooper, S.R. (Lawrence Berkeley Lab., CA). Contract W-7405-ENG-48. *ACS (American Chemical Society) Symposium Series ;* No. 131, 143-172(1980). (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

A class of sequestering agents has been designed and synthesized for the specific role of complexing plutonium and other actinide (IV) ions. The chemical properties of Pu(IV) and Fe(III) are similar in many respects and this similarity extends to the biological transport and distribution properties of Pu(IV). The design of specific sequestering agents for FE(III) was solved by microbes a few billion years ago with the production of low molecular-weight chelating agents (siderophores) that incorporate chelating groups such as hydroxamic acids and catechol. Synthetic macrochelates have been designed such that the chelating groups can form a cavity that gives eight-coordination about the metal and the dodecahedral geometry observed in the unconstrained actinide complexes composed of monomeric ligands. The most promising actinide sequestering agents yet prepared are the sulfonated catechoylamide derivatives of linear tetraamines. These compounds appear to strongly bind tetravalent actinides, while only weak complexation has been observed for trivalent and divalent metals. A derivative of the natural product spermine, 3,4,3-LICAMS, is more effective in plutonium removal at low dosages than any other sequestering agent tested to date.

22699 **Effect of cytosine arabinoside on the frequency of x-ray-induced chromosome aberrations in normal human leukocytes.** Preston, R.J. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Mutation Research ;* **69**: 71-79(1980).

The yield of x-ray-induced chromosome aberrations in unstimulated human lymphocytes is greatly enhanced when the cells are incubated with cytosine arabinoside (ara-C) after irradiation. There is an increase in aberration yield with increasing time of incubation in ara-C (1, 2 or 3 h). When $G_2$ cells are x-irradiated and incubated with ara-C until fixation, the deletion yields are considerably increased, but no interchanges are observed. In the absence of ara-C, 0.29 interchanges per cell were observed. The $G_2$ results suggest that ara-C inhibits the repair of damage that leads to the formation of exchange aberations. The increase in yield in unstimulated lymphocytes is interpreted to be due to an accumulation of strand breaks caused by ara-C inhibition of repair; when the inhibition is reversed with deoxycytidine, these breaks can interact to form aberrations. A possible mechanism for the induction of chromosome aberrations by x-rays is offered on the basis of these results.

22700 **Interactions of radiation and chemical carcinogens.** Ullrich, R.L. (Oak Ridge National Lab., TN). *Carcinogenesis (New York) ;* **5**: 169-184(1980).

It is apparent that, under the appropriate circumstances, when either uv or ionizing radiation is combined with chemical carcinogens, the times of tumor appearance are accelerated and/or the tumor incidences are increased. For uv irradiation this is generally true when care is taken to prevent photodecomposition of the chemical. In the studies outlined, uv radiation has been shown to be a promoting or enhancing agent for chemically initiated tumors and an initiating agent for chemically promoted tumors. When the levels of exposure of the two agents were carcinogenic by themselves, an accelerated response was observed, suggesting a summation effect. Although decomposition of the chemical is not a factor when ionizing radiation is used, doses must be sufficiently low so as to not cause substantial tissue destruction and cell killing. Under these circumstances, ionizing radiation has been shown to be an initiating agent when followed by chemical promotion, and this latent effect may persist for long periods of time. The enhancing or promoting effects of multiple doses have not been studied per se. The only data which might suggest an enhancing or promoting effect are those of Lurie and McGandy for multiple doses of radiation and chemical. Unfortunately, in these studies the two agents were delivered simultaneously so that cocarcinogenesis and enhancing effects cannot be separated When carcinogenic levels of ionizing radiation and chemical carcinogens have been given together, the effects have generally been additive. However, most of these data were obtained at relatively high carcinogenic doses of the two agents, and the importance of dose level has not been examined in any detail.

22701 **Measurement of pyrimidine dimers in spheroplasts of Bacillus subtilis.** Hadden, C.T. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Microbios ;* **24**: 113-122(1979).

A method is described for making spheroplasts of Bacillus subtilis which are permeable to exogenous enzymes. Conditions are described for measuring small numbers of pyrimidine dimers in the DNA of uv-irradiated cells by use of a partially purified Micrococcus luteus extract containing an enzyme specific for pyrimidine dimers. The system will detect as few as 10 to 12 pyrimidine dimers per genome.

## 5602 Thermal Effects

*REFER ALSO TO CITATION(S) 22007*

## 5603 Chemicals Metabolism And Toxicity

*REFER ALSO TO CITATION(S) 22362, 22585, 22586, 22589, 22591, 22593, 22600, 22635, 22700*

22702 **(CONF-800323—4) Tumorigenesis of diesel exhaust, gasoline exhaust, and related emission extracts on SENCAR mouse skin.** Nesnow, S.; Triplett, L.L.; Slaga, T.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.; Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01.

From Symposium on the application of short-term bioassays in the fractionation and analysis of complex environmental mixtures; Williamsburg, VA, USA (21 Mar 1980).

The tumorigenicity of diesel exhaust particulate emissions was examined using a sensitive mouse skin tumorigenesis model (SENCAR). The tumorigenic potency of particulate emissions from diesel, gasoline, and related emission sources was compared.

22703 (CONF-801045—, pp 65-90) **Statistical review of cross-sectional studies of ambient air pollution and mortality.** Ricci, P.F.; Wyzga, R.E. (Electric Power Research Inst., Palo Alto, CA). Apr 1981. NTIS, PC A11/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

The objective of this paper is to develop a systematic framework for reviewing studies of air pollution and mortality which use the General Linear Model. First, we introduce an array that allows a systematic comparison of the information content of each study. Second, we develop and apply a statistical framework to those studies to gain some understanding of the reliability of their results. We differentiate between major and minor statistical issues, which need be addressed in future research. The overall conclusion is that statistical studies which use the General Linear Model are limited in the application of available methods and tests, thereby raising several points of statistical contention.

22704 **(DOE/EV/02040—T1) Use of lymphoblastoid cells for the estimation of environmental insults to DNA. Comprehensive report of the overall activities of the contract during the past three years. Progress report, August 1, 1978-June 31, 1981.** (Chicago Univ., IL (USA)). 1981. Contract AS02-76EV02040. 8p. NTIS, PC A02/MF A01.

Research progress is reported on a study to detect chronic low-level exposure of individuals to polycyclic aromatic hydrocarbons by analysis of DNA in cells with low turnover rates. The technique used was to measure the level of excision repair activity in lymphoblastoid and lymphoma cell lines. (ACR)

22705 **(LA-UR—81-1166) Studies of the biology and toxicology of oilshale materials.** Holland, L.M. (Los Alamos Scientific Lab., NM (USA)). 1980. Contract W-7405-ENG-36. 17p. (CONF-800822—4). NTIS, PC A02/MF A01.

From Oil shale: the environmental challenges conference; Vail, CO, USA (11 Aug 1980).

This paper discusses the biological assessment of materials in relationship to probable exposure routes and attempts to describe the importance of the more fundamental bioassays in predicting eventual hazard. Routes of exposure discussed include: cutaneous, pulmonary, and systemic. The Ames test and other assays involving both cytotoxicity and mutagenesis and employing mammalian cells are being used to provide information to industrial hygienists for assessment of health hazards.

22706 **Retention of microspheres in the rat lung after intratracheal instillation.** Snipes, M.B.; Clem, M.F. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). Contract AC04-76EV01013. *Environmental Research ;* **24**: No. 1, 33-41(Feb 1981).

This 106-day study examined lung retention of 3-, 9-, and 15-μm polystyrene microspheres in Fischer 344 rats after intratracheal instillation. A mixture of microspheres, each size labeled with a different γ-emitting radionuclide, was instilled intratracheally into each rat. Three micrometer microspheres were retained in a manner similar to inhaled particles of a similar size; half of the microspheres were retained with a biological half-time of 12 days, the other half with a biological half-time of 69 days. Twenty-four and seventy-six percent of the 9-μm microspheres cleared with biological half-times of 17 and 580 days, respectively. Fourteen percent of the 15-μm microspheres cleared with a biological half-time of 2.3 days, the other microspheres were retained in the lung with a half-time which was not measurable over 106 days. Feces content of radionuclides paralleled lung clearance. The 3-μm microspheres translocated to the lung-associated lymph nodes; the 9- and 15-μm microspheres were not translocated to lymph nodes. Tissue data showed a fairly uniform dispersion of the three microsphere sizes in the lung. Results indicated that large particles which lodge in the deep lung could be retained indefinitely and yield unique chemical or radiation dose patterns to surrounding tissue.

22707 **Pathologic changes associated with experimental exposure of rats to coal dust.** Busch, R.H.; Filipy, R.E.; Karagianes, M.T.; Palmer, R.F. (Pacific Northwest Lab., Richland, WA). Contract AC06-76RLO-1830. *Environmental Research ;* **24**: No. 1, 53-60(Feb 1981).

Male Wistar rats were exposed to bituminous coal dust considered to have high potential for induction of coal workers' pneumoconiosis. They developed lesions similar to simple CWP as described in human subjects. Comparable lesions observed were macules which were of increased size, altered shape, and increased density in animals experiencing chronic exposures. More advanced lesion types, i.e., micronodule, macronodule, silicotic nodule, Caplan's lesion, and infective granuloma, were not observed in the experimental animals. Focal bronchiolization occurred in animals receiving at least 20 months' exposure. In the literature reviewed, this pathologic change is not described as a component of CWP.

22708 **Effect of lung damage by acute exposure to nitrogen dioxide on lung immunity in the rat.** Schnizlein, C.T. (Lovelace Inhalation Toxicology Research Inst., Albuquerque, NM); Bice, D.E.; Rebar, A.H.; Wolff, R.K.; Beethe, R.L. Contract AC04-76EV01013. *Environmental Research ;* **23**: No. 2, 362-370(Dec 1980).

Exposure to nitrogen dioxide damages Type I alveolar epithelial cells and the epithelium of the terminal bronchiole. Because an intact epithelium may help control the number of inhaled particles that are cleared by the pulmonary lymphatics, damage to the alveolar epithelium could alter the antigen load to the lung-associated lymph nodes. To determine the effects of lung damage by $NO_2$ inhalation on lung immunity, we exposed adult, male rats to 26 ppM $NO_2$ for 24 h at various time intervals before and after intratracheal immunization with $10^8$ sheep red blood cells. Seven days after immunization, we determined the number of anti-SRBC antibody-forming cells in the LALN, cervical lymph nodes, and spleen. The immunologic response to SRBC was limited to the LALN, with few or no AFC in either the cervical lymph nodes or spleen. A fivefold increase in the number of IgG anti-SRBC AFC/$10^6$ LALN cells was evident in rats immunized 1 day after $NO_2$ exposure. The increase was followed by a slight suppression of the IgG response when rats were immunized 3 days after exposure, returning to normal levels by 7 days after exposure. Histopathological examination of lung tissues showed a slight respiratory bronchiolitis which was followed by a bronchiolar epithelial cell hyperplasia and Type II cell hyperplasia in the adjacent alveoli. Based on these observations, it appears that the fluctuations observedin the LALN response may be the result of damage and subsequent repair of bronchiolar and alveolar epithelium following $NO_2$ inhalation.

**22709 Differential life-stage susceptibility of Acheta domesticus to acridine.** Walton, B.T. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Environmental Entomology ;* **9**: No. 1, 18-20(Feb 1980).

The toxicity of acridine to Acheta domesticus (L.) was determined to evaluate the potential for this pollutant from synthetic fuels production to affect insect populations. Acridine was highly toxic to cricket eggs but not toxic to nymphs or adults. An $LD_{50}$ for eggs = 7.4 μg/g was calculated from the $LC_{50}$ = 15.1 +- 0.61 ppM. The 24-h $LD_{10}$ of acridine to nymphal crickets was >332 μg/g. Male and female crickets consumed up to 1.0% of their weight in acridine over an 18-day period with no significant effect on mortality, weight gain, digestibility of food, or fecundity. Percent hatch of eggs from treated crickets (81.0 +- 6.7) was not significantly different from controls (77.2 +- 5.1).

**22710 Mutagenicity of N-nitrosopiperazine derivatives in Saccharomyces cerevisiae.** Larimer, F.W. (Oak Ridge National Lab., TN); Hardigree, A.A.; Lijinsky, W.; Epler, J.L. Contract W-7405-ENG-26. *Mutation Research ;* **77**: 143-148(1980).

The mutagenic properties of 8 N-nitrosopiperazines were examined in Saccharomyces cerevisiae. Forward mutations to canavanine resistance and reversions of his 1-7 were induced by N'-methyl-N-nitrosopiperazine, dinitrosopiperazine, 2-methyldinitrosopiperazine, 2,5-dimethyldinitrosopiperazine, and 2,6-dimethyldinitrosopiperazine, in the presence of rat-liver homogenate. N-nitrosopiperazine, 2,3,5,6-tetramethyldinitrosopiperazine, and 4-benzoyl-3,5-dimethyldinitrosopiperazine were non-mutagenic.

**22711 Alterations of two-dimensional electrophoretic maps in human peripheral blood lymphocytes induced by concanavalin A.** Willard, K.E.; Anderson, N.L. (Argonne National Lab., IL). Contract W-31-109-ENG-38. pp 415-424 of Electrophoresis '79. Advanced methods, biochemical and clinical applications. Radola, B.J. (ed.). Berlin, Germany; Walter de Gruyter and Company (1980).

These investigations demonstrate that con A-stimulated human lymphocytes are induced to undergo rapid protein synthesis. While some proteins seem to be synthesized in greater quantities than others, con A apparently does not induce any unique lymphocyte proteins during the time period examined.

**22712 Effects of $SO_2$ dosage kinetics and exposure frequency on photosynthesis and transpiration of kidney beans (Phaseolus vulgaris L.).** McLaughlin, S.B.; Sriner, D.S.; McConathy, R.K.; Mann, L.K. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Environmental and Experimental Botany ;* **19**: 1-191(1979).

The effects of variations in $SO_2$ dosage kinetics on bean plants (Phaseolus vulgaris L. red kidney) were studied at $SO_2$ levels equal to or below the current secondary ambient air quality standard. Response of photosynthesis, transpiration and growth were measured to evaluate the extent and duration of effects following repeated treatment at weekly (Experiment I) and daily (Experiment II) intervals. Depression of photosynthesis was the most consistent response observed. Transpiration was either stimulated or depressed by $SO_2$ concentrations which reduced photosynthesis. This effect indicates a probable biochemical rather than stomatal basis for observed photosynthetic depressions noted in these experiments. Increasing the peak: mean concentration ratio from 1.0 to 1.7 during exposure had no obvious effect on short-term photosynthetic response but caused apparent stimulation of photosynthesis one day later. Increasing the peak:mean ratio from 1.0 to 6.0 caused a threefold average greater depression of short-term photosynthetic response even though the 3 hr av. concentration was reduced by 25% (0.50 to 0.37). Residual effects from this treatment were generally small on the day after exposure. No strong evidence was obtained to indicate that plants were sensitized to $SO_2$-induced suppression of photosynthesis by previous exposure to $SO_2$. Predisposition was not apparent when exposures were repeated at weekly or daily intervals. Visible foliar injury did not occur. Analysis of harvest data at the end of these experiments indicated that plants could undergo a repeated short-term (1 day) cycle of photosynthetic inhibition and still retain an essentially unimpaired capacity for growth during a subsequent recovery period. When exposures were spaced a week apart, some indication of a residual effect on growth, particularly with the highest peak:mean ratio (6.0), was apparent.

**22713 Lack of enhancement of chemical mutagenesis by saccharin in the Salmonella assay.** Rao, T.K. (Oak Ridge National Lab., TN); Stoltz, D.R.; Epler, J.L. Contract W-7405-ENG-26. *Archives of Toxicology ;* **43**: 141-145(1979).

A purified batch of the artificial sweetener saccharin (S-1022) was assayed for mutagenicity and comutagenicity by the Ames Salmonella assay system. Saccharin was not mutagenic and failed to enhance the mutagenic activity induced by a wide variety of known mutagens. These results do not argue against the tumor-promoter-like activity of saccharin but only indicate that the Ames Salmonella assay is not capable of detecting saccharin as a promoter of mutagenesis.

**22714 Cytotoxicity and mutagenicity of alkylating agents in cultured mammalian cells (CHO/HGPRT system): mutagen treatment in the presence or absence of serum.** O'Neill, J.P.; Schenley, R.L.; Hsie, A.W. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Mutation Research ;* **63**: 381-385(1979).

Cytotoxicity and mutation induction at the hypoxanthine-guanine phosphoribosyl transferase locus in Chinese hamster ovary cells (CHO/HGPRT system) were measured for a range of concentrations of 6 alkylating agents [methyl and ethyl methanesulfonate (MMS, EMS), N-methyl- and N-ethyl-N'-nitro-N-nitrosoguanidine (MNNG, ENNG), and methyl- and ethyl-nitrosourea (MNU,ENU)] to determine the effect of the presence or absence of serum during the time of mutagen treatment. Cultures were treated with the mutagens for 5 h, a time period which results in no growth inhibition in the absence of serum, to estimate the potential decrease in effective mutagen dose to the cells which might result from reactivity with the serum proteins. With all 6 agents, identical results were found for cytotoxicity and for mutagenicity regardless of the presence or absence of serum during treatment. This finding demonstrates that the use of serum in cell-culture medium does not present any problems in apparent dosimetry studies, at least with these alkylating agents.

**22715 Quantitative mammalian cell mutagenesis and a preliminary study of the mutagenic potential of metallic compounds.** Hsie, A.W.; Johnson, N. (ed.)P.; Couch, D.B.; San Sebastian, J.R.; O'Neill, J.P.; Hoeschele, J.D.; Rahn, R.O.; Forbes, N.L. (Oak Ridge National Lab., TN). pp 55-69 of Trace metals in health and disease. Kharasch, N. (ed.). New York, NY; Raven Press (1979).

The system also appears to be suitable for studies of the mutagenicity and cytotoxicity of metallic compounds. We found that cis-dichlorodiammine Pt(II), [cis-$Pt(NH_3)_2Cl_2$], a widely used inorganic antitumor agent, is cytotoxic and mutagenic and that its mutagenicity correlates with its binding to DNA. However, trans-dichlorodiammine Pt(II), $K_2[PtCl_4]$, and $[Pt(NH_3)_4]Cl_2$ exhibit greatly reduced biological activities. Among 14 other metals studied, we found that carcinogenic metallic compounds such as $MnCl_2$, $NiCl_2$, and $BeSO_4$ are mutagenic, whereas noncarcinogenic compounds such as $MgCl_2$ and $H_2SeO_3$ are not. Determination of metal mutagenicity is apparently complicated by the ionic composition of the medium. For example, the mutagenicity and cytotoxicity increase with increasing $MnCl_2$ concentration when cells are treated with divalent-cation-deficient medium containing normal levels of $MgCl_2$; however, both of these effects are diminished by increasing $MgCl_2$ concentration. The unusual environment required for demonstration of the mutagenicity of $MnCl_2$ complicates the assessment of its biological hazard. This may account in part for varying results in studies of the mutagenicity of other metallic compounds. Further refinement of the assay conditions, especially with respect to the ionic environment necessary for quantifying mutagenicity of each metallic agent, is in progress.

**22716 Studies of pollutant aerosol simulants in normal and susceptible human subjects.** Morrow, P.E.; Utell, M.J.; Gibb, F.R.; Hyde, R.W. (Univ. of Rochester School of Medicine and Dentistry, NY). pp 11-20 of Aerosols in science, medicine and technology: the biomedical influence of the aerosol. Stoeber, W.; Jaenicke, R. (eds.). Mainz, Germany; Association for Aerosol Research (1979).

From 7. conference of Association for Aerosol Research; Duesseldorf, Germany (3 Oct 1979).

These double-blind studies indicate that subpopulations of susceptible subjects are readily distinguished from normal subjects using physiological assessments after brief exposure to occupationally-acceptable concentrations of sulfate and nitrate aerosols. Because influenza patients responded to a neutral nitrate salt, $NaNO_3$, and not NaCl, it appears probable that nitrate has a specific bronchial action. That normal subjects responded to these levels of acidic sulfate aerosols suggests even lower levels may elicit bronchomotor reactions in susceptible groups. Experiments are planned to verify this presumption. These studies do not prove that the substances studied are the etiological factors in air pollution morbidity, nor was this their objective. They were undertaken principally to establish an investigative approach. We believe that future studies, using other time-concentration protocols and the approach described, will prove useful in further clarifying the differences in normal and susceptible populations toward air pollutants and in providing additional dose-response data which may sharpen our perception of the etiological factors in air pollution and reveal how they produce their adverse effects.

22717 **Chemical carcinogenesis. Chapter 12.** Selkirk, J.K. (Oak Ridge National Lab.). pp 455-478 of Burger's medicinal chemistry. Part I. The basis of medicinal chemistry. Wolff, M.E. (ed.). New York, NY; John Wiley and Sons, Inc. (1979).

With the advent of the industrial revolution it became apparent that carcinogenic chemicals pose hazards to human health. During the last century the exponential growth of chemical technology resulted in the development of vast amounts of synthetic compounds such as cosmetics, food preservatives, and colorants, for industry, agriculture, and medical and consumer products. Most of these compounds are not natural to the environment, and some are already toxic by their inherent chemical structure. However others are inert when released into the air, water, or soil but are taken into the organism and activated by biochemical processes to form toxic, carcinogenic, or mutagenic derivatives.

22718 **Modification of erythrocyte physicochemical properties by millimolar concentrations of glutaraldehyde.** Corry, W.D.; Meiselman, H.J. (Univ. of Southern California, Los Angeles). *Blood Cells ;* **4**: 465-480(1978).

The effects of low levels of glutaraldehyde uptake ($<120$ $\mu mol/10^{10}$ cells) on the physicochemical properties of human red blood cells (RBC) were investigated. Salient effects include: (1) by different measures of cell deformability, the extent of glutaraldehyde uptake required to decrease cellular deformability was shown to range from approximately 8 to 30 $\mu mol/10^{10}$ cells; (2) osmotically stressed red cells exhibit complete hemolysis when the level of glutaraldehyde uptake is $<28$ $\mu mol/10^{10}$ cells and no hemolysis when uptake is $>70$ $\mu mol/10^{10}$ cells with the extent of hemolysis decreasing in an approximately linear manner with glutaraldehyde uptake between these limits; (3) glutaraldehyde uptake of up to 58 $\mu mol/10^{10}$ cells does not change the cells' density, mean cell volume or ability to retain potassium.

22719 **(DOE/EV/02737—9) Temporal aspects of tumorigenic response to individual and mixed carcinogens. Progress report.** Albert, R.E.; Burns, F.J.; Altshuler, B. (New York Univ., NY (USA). Inst. of Environmental Medicine). [nd]. Contract AS02-76EV02737. 91p. NTIS, PC A05/MF A01.

The research is designed to obtain a better understanding of the temporal kinetics of tumor induction when one or more carcinogens are present simultaneously or sequentially for prolonged periods of time. Studies done to date under this contract have shown that carcinogenesis in mouse skin by polycyclic aromatic hydrocarbon carcinogens is consistent with the induction of dependent and autonomous cell transformations by the carcinogen followed by the conversion of autonomous tumor cells into malignancies at a rate which is determined by the level of carcinogen exposure. Dependent cell transformations remain latent in the skin unless expressed by a promoting agent. Dependent neoplasia appears to follow one-hit kinetics while malignancy is a multihit endpoint. Dose-related and time-related aspects of tumor induction are separable in the initiation-promotion system of mouse skin which along with rat skin and hamster lung is being used as a model for testing hypotheses. Results to date provide the basis for a new interpretation of the linear non-threshold extrapolation model. The broad aim of the study is to provide a basis or rationale for estimating risks associated with prolonged exposures to carcinogens found in the environment and to predict how different tissues and species respond to the carcinogens, promoters and cocarcinogens.

### 5604 Other Environmental Pollutant Effects

22720 **Advances in microwave-induced neuroendocrine effects: the concept of stress.** Lu, S.T.; Lotz, W.G.; Michaelson, S.M. (Univ. of Rochester, NY). *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) ;* **68**: No. 1, 73-77(Jan 1980).

Recent evidence indicates that neuroendocrine effects are induced by microwave exposure with a threshold intensity required for the onset of the response. The level of that threshold is dependent upon intensity and duration of exposure. The threshold can vary with the given endocrine parameter studied. The response of the endocrine systems appears to be a nonspecific stress reaction in the case of adrenocortical and growth hormone changes, but it is apparently a metabolically specific response to increased energy input in the case of pituitary-thyroid changes.

22721 **Highway right-of-way: mowing versus succession as related to duck nesting.** Voorhees, L.D.; Cassel, J.F. (North Dakota State Univ., Fargo). *Journal of Wildlife Management ;* **44**: No. 1, 155-163(1980).

Alternate 1.6-km blocks of a 37-km section of a grass-forb community along Interstate 94 right-of-way in Stutsman County, North Dakota, were maintained in an early successional stage by annual fall mowing; the remaining 1.6-km blocks, representing later successional stages, were left unmowed. The preference for unmowed vegetation by nesting ducks did not vary over a 4-year period as the vegetation aged ($P > 0.10$). However, patterns of nest success were different in the 2 habitats ($P < 0.01$). Nest success did not vary in the mowed blocks ($P > 0.10$) but declined continually in unmowed areas ($P < 0.001$). Nest location and success are discussed in relation to changes in the vegetation, and specific management recommendations are given.

## 58 GEOSCIENCES

### 5801 Geology And Hydrology

*REFER ALSO TO CITATION(S) 21684, 22561, 22565*

22722 **(DOE/ET/44802—T1) Correlation characteristics of surficial deposits with a description of surficial stratigraphy in the Nevada test site region.** Hoover, D.L.; Swadley, W.C.; Gordon, A.J. (Geological Survey, Denver, CO (USA)). 1981. Contract AI08-78ET44802. 32p. NTIS, PC A03/MF A01.

Surficial deposits in the Nevada Test Site region have been correlated between valleys using correlation characteristics. Correlation characteristics include topography, drainage, topographic relationships, soils, desert pavement, depositional environment, and lithology. Stratigraphic units include Pliocene or Pleistocene debris flows, Pliocene or Pleistocene lakebeds, bedded gravels, and spring deposits, and two Quaternary fluvial and eolian units. The Pliocene or Pleistocene debris flows and the two Quaternary units are separated by regional unconformities. Each of the Quaternary units contains five subunits. The Bishop ash and several radiometric dates have been used to determine the age of the Quaternary units.

22723 **(DOE/RG—0059) Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report.** Saguinsin, J.L.S.; Bynoe, M.C.; Tsai, Y.H.; Zussman, S.K. (Argonne National Lab., IL (USA)). Apr 1981. Contract W-31-109-ENG-38. 90p. NTIS, PC A05/MF A01. Order Number DE81024015.

This document is a description of the existing geohydrology of the Northeast Region and is a supplement to the Task Report on

waste disposal resulting from conversion to coal of powerplants in the Northeast Region of the United States. The coverage includes geology and hydrology of the Northeast Region, including topography and physiography, and surface water and groundwater resources. This document provides a baseline characterization of the existing geohydrologic environment that may be affected by the disposal of utility-generated coal-combustion wastes, including ash and sludge from flue-gas desulfurization. This baseline description should be helpful in the selection of environmentally acceptable sites for disposal of combustion wastes and should serve as a basis for the design of mitigating measures (e.g., lining of landfill areas) where such need arises.

22724 (LBL—12548, pp 53-57) **Thermal-gradient migration of brine inclusions in salt.** Machiels, A.J.; Yagnik, S. Dec 1980. NTIS, PC A04/MF A01.

In Nuclear materials progress reports for 1980.

Experiments show that the inclusion speed is controlled principally by the rate of solid dissolution at the hot face of the inclusion. The dislocation-controlled migration process explains the experiments. 2 figures. (DLC)

22725 **(PNL-SA—9096) Geostatistical modeling of pore velocity.** Devary, J.L.; Doctor, P.G. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Mar 1981. Contract AC06-76RL01830. 38p. (CONF-810372—2). NTIS, PC A03/MF A01.

From Symposium on uncertainties associated with the regulation of the geologic disposal of high-level radioactive waste; Gatlinburg, TN, USA (9 Mar 1981).

A significant part of evaluating a geologic formation as a hazardous waste repository involves the modeling of contaminant transport in the surrounding media in the event the repository is breached. The commonly used contaminant transport models are deterministic. However, the spatial variability of hydrologic field parameters introduces uncertainties into contaminant transport predictions. This paper discusses the application of geostatistical techniques to the modeling of spatially varying hydrologic field parameters required as input to contaminant transport analyses. Kriging estimation techniques were applied to Hanford Reservation field data to calculate media conductivity and the ground-water potential gradients. These quantities were statistically combined to estimate the ground-water pore velocity and to characterize the pore velocity estimation error. Combining geostatistical modeling techniques with product error propagation techniques results in an effective stochastic characterization of ground-water pore velocity, a hydrologic parameter required for contaminant transport analyses.

22726 **(UCRL—85411) Geohydrology of Enewetak Atoll islands and reefs.** Buddemeier, R.W. (Lawrence Livermore National Lab., CA (USA)). 6 May 1981. Contract W-7405-ENG-48. 17p. (CONF-810547—1). NTIS, PC A02/MF A01.

From 4. international coral reef symposium; Manila, Philippines (18 May 1981).

Extensive tidal studies in island wells and the lagoon at Enewetak Atoll have shown that island ground water dynamics are controlled by a layered aquifer system. The surface aquifer of unconsolidated Holocene material extends to a depth of approximately 15 m, and has a hydraulic conductivity K = 60 m/day. From 15 to 60 m (approximate lagoon depth) the reef structure consists of successive layers of altered Pleistocene materials, with bulk permeability substantially higher than that of the surface aquifer. Because of wave set-up over the windward reef and the limited pass area for outflow at the south end of the atoll, lagoon tides rise in phase with the ocean tides but fall later than the ocean water level. This results in a net lagoon-to-ocean head which can act as the driving force for outflow through the permeable Pleistocene aquifer. This model suggests that fresh water, nutrients or radioactive contaminants found in island ground water or reef interstitial water may be discharged primarily into the ocean rather than the lagoon. Atoll island fresh water resources are controlled by recharge, seawater dilution due to vertical tidal mixing between the surface and deeper aquifers, and by loss due to entrainment by the outflowing water in the deeper aquifers. Estimated lagoon-ot-ocean transit times through the deep aquifer are on the order of a few years, which corresponds well to the freshwater residence time estimates based on inventory and recharge. Islands in close proximity to reef channels have more fresh ground water than others, which is consistent with a locally reduced hydraulic gradient and slower flow through the Pleistocene aquifers.

22727 **Desert varnish: potential for age dating via uranium-series isotopes.** Knauss, K.G.; Ku, T.L. (Lawrence Livermore National Lab., CA). Contract W-7405-ENG-48. *Journal of Geology ;* **88**: No. 1, 95-100(Jan 1980).

Trace metals and natural radioisotopes are measured in an unusually thick and presumed ancient desert varnish from the Colorado Plateau in Utah. Uranium and thorium concentrations in the sequence: varnish--altered rind--heartrock (Shinarump formation sandstone) indicate that uranium with little accompanying thorium is derived from external sources. The varnish forms a closed system for $^{230}Th$ and $^{231}Pa$ with equilibrium values for both $^{230}Th/^{234}U$ and $^{231}Pa/^{235}U$. Selective leaching of the ferromanganese oxides followed by analysis of both the leachate and silicate residue is proposed to allow age determinations.

## 5802 Geophysics

*REFER ALSO TO CITATION(S) 21545, 21546, 21642*

22728 **Geophysical investigations in deep horizontal holes drilled ahead of tunnelling.** Carroll, R.D.; Cunningham, M.J. (Geological Survey, Denver, CO). *International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts ;* **17**: 89-107(1980).

Deep horizontal drill holes have been used since 1967 by the Defense Nuclear Agency as a primary exploration tool for siting nuclear events in tunnels at the Nevada Test Site. The US Geological Survey has developed geophysical logging techniques for obtaining resistivity and velocity in these holes, and to date 33 horizontal drill holes in excess of 300 m in depth have been successfully logged. The deepest hole was drilled to a horizontal depth of 1125 m. The purposes of the logging measurements are to define clay zones, because of the unstable ground conditions such zones can present to tunnelling, and to define zones of partially saturated rock, because of the attenuating effects such zones have on the shock wave generated by the nuclear detonation. Excessive attenuation is undesirable because the shock wave is used as a tunnel closure mechanism to contain debris and other undesirable explosion products. Measurements are made by pumping resistivity, sonic and geophone probes down the drill string and out of the bit into the open hole. Clay zones are defined by the electrical resistivity technique based on empirical data relating the magnitude of the resistivity measurement to qualitative clay content. Rock exhibiting resitivity of less than 20 ohm-m is considered potentially unstable, and resistivities less than 10 ohm-m indicate appreciable amounts of clay are present in the rock. Partially saturated rock zones are defined by the measurement of the rock sound speed. Zones in the rock which exhibit velocities less than 2450 m/sec are considered of potential concern.

## 5803 Mineralogy, Petrology, And Rock Mechanics

*REFER ALSO TO CITATION(S) 21575, 21656, 21686*

22729 **(DP-MS—80-119) Clay mineralogy of selected sediments and soils at the Savannah River Plant, Aiken, South Carolina.** Ruhe, R.V.; Matney, E.A. (Indiana Univ., Bloomington (USA)). 1979. Contract AC09-76SR00001. 59p. NTIS, PC A04/MF A01.

Six samples of stream and pond sediments, six soil samples, one sample of sluiced fly ash, and one sample of precipitated coal ash from the Savannah River Plant were selected for clay-mineral studies. Among the sediments and soils, only one sample contained kaolinite, illite, and a 14 A mineral which expanded after glycolation and collapsed after heating. All other sediments and soils contained only kaolinite and a 14 A mineral which did not expand after glycolation and which collapsed progressively toward 10 A at successively higher temperature heating. The percentages of clay minerals were estimated by using the recently developed method of adding increasing proportions of soil clay to a constant standard.

All sediments and soils were acidic, had low cation-exchange capacities, and were deficient in extractable bases. They were derived from or were part of Ultisols, which are rather severely weathered soils. The fly and coal ash were essentially composed of minerals of low- and high-temperature quartz and a fired product of alumina-silica (mullite). The x-ray analyses were verified by elemental chemical analyses by using inductively coupled plasma-optical emission spectrometry.

22730 **(LBL—12511) New approaches to problems of fluid flow in fractured-rock masses.** Witherspoon, P.A.; Tsang, Y.W.; Long, J.C.S.; Noorishad, J. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 21p. (CONF-810624—7). NTIS, PC A02/MF A01.

From 22. US symposium on rock mechanics; Cambridge, MA, USA (29 Jun 1981).

Investigations on the factors that control the movement of fluids in the underground inevitably become involved with fractured rock masses. We shall address three different aspects of this problem in an effort to describe some investigations currently underway in this laboratory. The first part of this paper is an attempt to develop an expression for fluid flow in a deformable fracture. Our approach to this problem of the hydromechanical behavior of a deformable fracture differs from that of Gangi (1978) although we both have a common starting point, the roughness of the fracture surface. The second part has to do with the problem of how to treat flow through networks of fractures. It is customary to consider a discontinuous rock mass by some equivalent porous medium but this raises some important questions that will be discussed. The third part will present the most recent results by our group to develop a fully coupled finite element code for flow through fractured porous media subject to thermal, hydraulic and mechanical stresses.

22731 **(SAND—81-7063) Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests.** Pfiefle, T.W.; Senseny, P.E. (RE/SPEC, Inc., Rapid City, SD (USA)). May 1981. Contract AC04-76DP00789. 130p. NTIS, PC A07/MF A01.

Constant stress-rate triaxial compression experiments were performed on specimens of anhydrite and polyhalite at low confining pressure and at two temperatures. The loading rate was 5.75 x $10^{-2}$ MPa $s^{-1}$; the confining pressures were 1, 5, 10, and 20 MPa and the two temperatures were 25°C and 100°C. The specimens were loaded to failure in a soft testing machine so that failure occurred at peak stress. Results from these experiments were used to construct yield envelopes, failure envelopes and stress-strain curves, and to determine mechanical properties. Yield, determined by the onset of dilatancy, occurs at about sixty percent of peak stress. The effect of temperature on both the yield and failure envelopes is negligible. The polyhalite specimens were found to be about twice as strong as the anhydrite specimens. The stress-strain data were fitted to a constitutive law.

22732 **(UCID—19047) JPLAXD: a finite-element program for static plane and axisymmetric analysis of structures in jointed rocks.** Heuze, F.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1981. Contract W-7405-ENG-48. 54p. NTIS, PC A04/MF A01.

JPLAXD is a finite element program for static plane and axisymmetric analysis of structures in jointed rock. The code was developed by F. Heuze, starting from the plane formulations of Wilson and Goodman. Over the years, numerous features have been added to the plane option, such as: peak and residual behavior in the solids, with strain softening and dilatancy, peak and residual behavior in the joints, with strain softening and dilatancy, automatic reset of solid and joint compliances, RESTART mode for sequential excavation or construction, plotting routines for display of deformations and stresses, and transversely isotropic materials. In addition, the code was extended to axisymmetric analysis, including all the above developments. The program has been used on variety of basic and applied rock mechanics problems.

22733 **Dynamic viscosity of some silicate melts to 1688°C under atmospheric pressure.** Piwinskii, A.J.; Weed, H.C. (Univ. of California, Livermore). Contract W-7405-ENG-48. *Thermochimica Acta ;* **37**: 189-195(1980).

The dynamic viscosity of six anhydrous silicate melts, obtained by fusing rocks collected from the Department of Energy's Nevada Test Site, has been measured from 1120 to 1688°C under atmospheric pressure using a rotational cup viscometer of the Couette type. The melts exhibit Newtonian behavior in this temperature interval. Melt viscosities decrease in the order: tuff > alluvium > basalt. Activation energy for viscous flow in the interval 1120 to 1688°C ranges from 268 to 383 kJ.

22734 **Partial molar volumes of oxide components in silicate liquids.** Nelson, S.A.; Carmichael, I.S.E. (Lawrence Berkeley Lab., CA). Contract W-7405-ENG-48. *Contributions to Mineralogy and Petrology ;* **71**: 117-124(1979).

Densities of 21 silicate liquids have been determined from 1000° to 1600°C. The compositions studied contain from two to eight oxide components and have the following ranges in composition (mole %): $SiO_2$, 35 to 79%; $TiO_2$, 4 to 36%; $Al_2O_3$, 5 to 25%; FeO, 11 to 41%; MgO, 7 to 28%; CaO, 7 to 35%; $Na_2O$, 5 to 50%; and $K_2O$, 4 to 20%. The compositions thus cover the upper range observed in magmas for each oxide. Precision for each determination of liquid density is always better than +- 1%. Volumes/gfw (gram formula weight) calculated from the density measurements and the chemical compositions of the analyzed liquids have been combined with data on 96 silicate liquids reported in the literature. From this data set we derive, by using multiple linear regression, partial molar volumes of the components $SiO_2$, $TiO_2$, $Al_2O_3$, FeO, MgO, CaO, $Na_2O$, and $K_2O$ at five temperatures. The standard deviation of the multiple regression is 1.8% of the molar volumes, which is considered about equal to the total errors due to compositional and instrumental uncertainties. These derived partial molar volumes have been used to calculate volumes/gfw of natural silicate liquids which are found to agree within 1% of the measured values. No compositional dependence of the partial molar volumes can be detected within the error considered to be typical of the measurements. This is further supported by the close agreement between the calculated volumes of $CaMgSi_2O_6$ and $Fe_2SiO_4$ liquids derived from the initial slopes of their fusion curves and their heats of fusion, and the volumes obtained by summing the respective partial molar volumes. The experimental data indicate that silicate liquids mix ideally with respect to volume, over the temperature and composition range of this data set.

## 5804 Geochemistry

22735 **Regular solution model for met-aluminous silicate liquids: applications to geothermometry, immiscibility, and the source regions of basic magmas.** Ghiorso, M.S.; Carmichael, I.S.E. (Lawrence Berkeley Lab., CA). *Contributions to Mineralogy and Petrology ;* **71**: 323-342(1980).

Adopting a set of multioxide components and using published compositional data on olivine- and plagioclase-liquid equilibria we have developed a 17 component regular solution model for met-aluminous silicate liquids. The partial molar excess free energies predicted from this model can be used together with phenocryst compositions as an effective geothermometer, with an approximate error of 20°C (30°C for olivine, 12°C for plagioclase). The regular solution formulation is also successful in predicting liquid immiscibility at (1) high mole fractions of silica commonly observed in phase diagrams, and at (2) lower temperatures in lunar basalts and intermediate lavas. The model yields activities of silica which are consistent with those obtained from solid-liquid silica buffers in rocks which contain olivine and enstatite or quartz. From predicted activities of $KAlSi_3O_8$ in liquids coexisting with plagioclase a value is obtained for the limiting Henry's law activity coefficient of $KAlSi_3O_8$ in the solid. This coefficient agrees well with that inferred from plagioclase-sanidine equilibrium phenocryst assemblages in rhyolites. The activities of silica obtained from this model are used to place constraints on the pressure-temperature regions where various types of basic magmas are generated. In conjunction with plagioclase geothermometry an application is given where the pressure, temperature, and water content of an olivine andesite is predicted from the activity of silica.

# 64 PHYSICS RESEARCH

## 6401 Astrophysics And Cosmology

*REFER ALSO TO CITATION(S) 22511*

**22736 (BNL—29440) Solar neutrino experiments and neutrino oscillations.** Cleveland, B.T.; Davis, R. Jr.; Rowley, J.K. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 14p. (CONF-810135—3). NTIS, PC A02/MF A01.

From Neutrino oscillation workshop; Upton, NY, USA (30 Jan 1981).

This report gives the results of the Brookhaven solar neutrino experiment that is based upon the neutrino capture reaction, $^{37}Cl(\nu,e^-)^{37}Ar$. The experiment was built in 1967 to test the theory of solar energy production, and it is well known that the neutrino capture rate in the detector is lower than that expected from theoretical models of the sun. The results will be compared to the current solar model calculations. One possible explanation of the low solar neutrino capture rate is that the neutrinos oscillate between two or more neutrino states, a topic of particular interest to this conference. This question is discussed in relation to the $^{37}Cl$ experiment, and to other solar neutrino detectors that are capable of observing the lower energy neutrinos from the sun. A radiochemical solar neutrino detector located deep underground has a very low background and is capable of detecting the monoenergetic neutrinos from megacurie sources of radioisotopes that decay by electron capture. Experiments of this nature are described that are capable of testing for neutrino oscillations with a $om^2$ as low as 0.2 $eV^2$ if there is maximum mixing between two neutrino states.

**22737 (BNL—29527) Carbon and carbon-14 in lunar soil 14163.** Fireman, E.L.; Stoenner, R.W. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA); Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 19p. (CONF-810378—1). NTIS, PC A02/MF A01.

From 12. lunar and planetary science conference; Houston, TX, USA (16 Mar 1981).

Carbon is removed from the surface of lunar soil 14163 size fractions by combustions at 500 and 1000°C in an oxygen stream and the carbon contents and the carbon-14 activities are measured. The carbon contents are inversely correlated with grain size. A measured carbon content of 198 ppM for bulk 14163, obtained by combining the size fraction results, is modified to 109 +- 12 ppM by a carbon contamination correction. This value is in accord with a previous determination, 110 ppM, for bulk 14163. The small (< 53 $\mu$) grains of 14163 had more combusted carbon-14 activity, 31.2 +- 2.5 dpm /kg, than the large (> 53 $\mu$) grains, 11.2 +- 2.0 dpm/kg. The combusted carbon and carbon-14 are attributed mainly to solar-wind implantation. Melt extractions of carbon-14 from the combusted soil samples gave essentially identical activities, 21.0 +- 1.5 and 19.2 +- 2.0 dpm/kg for the small and large grains, and are attributed to cosmic-ray spallation-produced carbon-14.

**22738 (DOE/ER/04634—1) Mechanism for the effects of variable solar activity on the weather. Final report.** (Aspen Inst. for Humanistic Studies, Boulder, CO (USA)). 1981. Contract AS02-78ER04634. 6p. NTIS, PC A02/MF A01.

The goal of the research was to help in identifying the most likely physical mechanisms for the effects of variable solar activity on the weather. The method of attack was largely empirical, and this method was chosen for the following reasons: (1) in order to tap the great pool of scientific talent that may be able to offer sound physical mechanisms, it is necessary to demonstrate that there are some important relationships to explain; and (2) if the experiments are carefully designed, they can be useful in eliminating certain mechanisms which seem to have a low probability of success, and picking out the mechanisms which look more promising. Some results are presented.

**22739 (LA-UR—81-965) Galactic origin of cosmic rays I.** Colgate, S.A. (Los Alamos National Lab., NM (USA); New Mexico Inst. of Mining and Technology, Socorro (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-810711—1). NTIS, PC A02/MF A01.

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

The theoretical basis for the supernova envelope shock origin of cosmic rays is reviewed. The theoretical explanation of the SN Type I light curve requires the ejection of a relativistic mass fraction. The criterion of the adiabatic decelleration by Alfven wave trapping neither applies in theory, when $\beta > 1$, or practice, the Starfish high altitude nuclear explosion experiment. Arguments of delayed acceleration due to K-capture are not applicable to SN ejecta because a period of prompt recombination exists before subsequent stripping in propagation.

**22740 (LA-UR—81-966) Galactic origin of cosmic rays II.** Colgate, S.A. (Los Alamos National Lab., NM (USA); New Mexico Inst. of Mining and Technology, Socorro (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-810711—2). NTIS, PC A02/MF A01.

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

The CR acceleration due to shocks in the ISM depends upon multiple crossings $\sim = c/3$ v/sub Alfven/ $\sim = 10^4$ per e-fold energy gain. The up-stream scattering required to produce this barrier is Alfven wave turbulence. When the ratio (CR pressure)/($B^2/8\pi$) identical = $\beta > 1$, the streaming velocity theoretically and observationally becomes >> v/sub Alfven/ and, hence, no effective up-stream barrier is likely to exist. If all ISM shock acceleration is limited to $\beta \sim << 1$ and the average galactic CR conditions is $\beta \sim = 1$, then shocks in the ISM are unlikely to supply the necessary acceleration. This is particularly so for high energy CR's accelerated early in the remnant history where $\beta$ must be large and the number of e-folds required are large. High energy CR's can be produced by the shock breaking out of the envelope into the magnetosphere of the SN star for $E \sim > 10^{13}$ to $10^{14}$ eV. It is usually assumed that the energy dependent escape from the Galaxy $E \sim > 10^{15}$ eV produces a steeper spectrum from $10^{15}$ to $10^{18}$ eV. Above this energy SN's in all galaxies fill the meta galaxy with CR's with a flatter slope. Conversely, an external source that attempts to fill the Galaxy from the outside must have a still steeper spectrum $\Delta\Gamma \sim = -.75$ to penetrate the diffusive barrier of our galaxy yet maintain the observed slope. This is unlikely since the energy density at $10^{15}$ eV in the meta galaxy would be between $10^{-1}$ to $10^{-2}$ of CR's in this galaxy or of the order of $10^3$ of the energy density of particles and fields in the IGM.

**22741 Anomalous isotoptic composition of cosmic rays.** Woosley, S.E.; Weaver, T.A. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California at Santa Cruz; and Lawrence Livermore Laboratory). *Astrophysical Journal ;* **243**: No. 2, 651-659(15 Jan 1981).

Recent measurements of nonsolar isotopic patterns for the elements neon and (perhaps) magnesium in cosmic rays are interpreted within current models of stellar nucleosynthesis. One possible explanation is that the stars currently responsible for cosmic-ray synthesis in the Galaxy are typically super—metal-rich by a factor of 2—3. Other possibilities include the selective acceleration of certain zones or masses of supernovae or the enhancement of $^{22}Ne$ in the interstellar medium by mass loss from red giant stars and planetary nebulae. Measurements of critical isotopic ratios are suggested to aid in distinguishing among the various possibilities. Some of these explanations place signficant constraints on the fraction of cosmic-ray nuclei that must be fresh supernova debris and the masses of the supernovae involved.

**22742 Analyais of solar X-ray emission line profiles.** Burek, A.J.; Marrus, D.M.; Blake, R.L.; Fenimore, E.E. (National Bureau of Standards). *Astrophysical Journal ;* **243**: No. 2, 660-676(15 Jan 1981).

We report results of the analysis of the X-ray emission line profiles for the Ne X La and Fe XVII 4d $^1P_1$ lines produced in an active region that was undergoing a radio and X-ray gradual rise

and fall (GRF) in intensity. The spectra were obtained with collimated Bragg spectrometers launched on a rocket from White Sands Missile Range on 1976 March 26. Using a crystal of ammonium acid phthalate, we have fully resolved the Ne X La and Fe XVII 4d $^1P_1$ lines, permitting an accurate determinination of the Ne X La intensity and allowing Doppler broadened profiles for lines formed from ions having greatly different atomic mass and charge to be measured. An isothermal model derived from the Ne IX/Ne X resonance line intensity ratio gives an electron temperature of 3.4 x $10^6$ K. An isothermal model, however, fails to account for the intensities of all lines and continuum observed. All multitemperature models that do reproduce the observed relative line intensities require the presence of a hot plasma component with an electron temperature in excess of 5 x $10^6$ K. The presence of a high temperature component is also suggested by the measured line to continuum ratio of 3.6 in the 12—15 A wavelength interval. Interpretation of the line profiles in terms of a multitemperature model requires an rms turbulence velocity of 48 +- 15 km $s^{-1}$ for Fe XVII $^1P_1$ and 74 +- 54 km $s^-2$! for Ne X La at the 95% confidence level. Collimated scans across the active region show the presence of a compact source of intense X-ray emission close to the magnetic neutral line, which is very probably the GRF plasma.

## 6402 Atmospheric Physics

*REFER ALSO TO CITATION(S) 22738*

**22743 (CONF-810421—3) Occultation of the ATS-3 satellite by the AVEFRIA barium ion cloud.** Fitzgerald, T.J.; Simons, D.J.; Pongratz, M.B.; Clynch, J.R. (EG and G, Inc., Los Alamos, NM (USA); Los Alamos National Lab., NM (USA); Texas Univ., Austin (USA). Applied Research Labs.). 1981. Contract AC08-76NV01183. 8p. NTIS, PC A02/MF A01.

From Ionospheric effects symposium; Alexandria, VA, USA (14 Apr 1981).

During the AVEFRIA DOS barium release experiment, sponsored by the Los Alamos National Laboratory and the Defense Nuclear Agency in May 1978, the line of sight from one of the ground observation stations to the ATS-3 satellite was occulted by the barium ion cloud for a period of approximately five minutes. Optical measurements of the structured barium ion cloud were made with intensified cameras using the 455.4-nm wavelength fluorescent ion line. These measurements have been related to barium ion column density. During the occultation, the amplitude scintillations of the 136.47-MHz signal from the ATS-3 satellite were monitored. The optical measurements have been used to correlate the barium column density with the total electron content measurements and to calculate the scintillation index, $S_4$, and the two dimensional intensity pattern for comparison with the measured amplitude scintillations.

**22744 (SAND—81-0482) Description of the wind profile system developed for the PLACES test series.** Finnell, R.T. (Sandia National Labs., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 87p. NTIS, PC A05/MF A01.

The PLACES experiments were conducted to investigate the effects of ionospheric plasmas (created by the release of barium vapor) on satellite communication and navigation systems. A wind profile system was developed to assist in determining launcher setting angles. The system functioned properly.

**22745 (SAND—81-0483) Description of the barium cloud vectoring systems developed for the PLACES test series.** Finnell, R.T. (Sandia National Labs., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 189p. NTIS, PC A09/MF A01.

The PLACES experiments were conducted to investigate the effects of ionospheric plasmas (created by barium vapor released from rockets) on satellite communications and navigation systems. Launcher setting angles for the rockets were provided by a minicomputer system made up of four subsystems. This report describes the subsystems which determined the barium cloud vectors from TV data alone and from combined radar/TV data.

**22746 Measurements of long delayed radio echoes in the auroral zone.** Freyman, R.W. (Los Alamos National Laboratory, Los Alamos, NM 87545). *Geophysical Research Letters ;* **8**: No. 4, 385-388(Apr 1981).

A high-latitude, earth-based high-frequency (9.9MHz) radiowave backscatter technique for the real-time detection of Long Delayed Echoes was tested at College, Alaska. Over 2000 apparent LDE were detected and recorded from 15 to 22 July, 1980.

## 6403 Atomic, Molecular, And Chemical Physics

*REFER ALSO TO CITATION(S) 22285, 22322, 22813, 22951*

**22747 Matrix interactions with rare-gas oxide excimers.** Taylor, R.V.; Scott, W.; Findley, P.R.; Wu, Z.; Walker, W.C.; Monahan, K.M. (Physics Department, University of California, Santa Barbara, California 93106). *Journal of Chemical Physics, The ;* **74**: No. 7, 3718-3722(1 Apr 1981).

Matrix interactions of rare-gas oxide molecules formed in solid matrices were studied by photoluminescence. Excitation energies between 8—12 eV were provided by both synchrotron radiation at the Stanford Synchrotron Radiation Laboratroy (SSRL) and a hydrogen discharge source at UCSB. Photoluminescence emission and excitation spectra of Ar:$CO_2$(1%), Kr:$CO_2$(1%), Kr:$N_2O$(1%), and Kr:$O_2$(1%) mixtures were obtained. Radiative lifetimes of ArO and KrO emissions from $CO_2$ doped Ar and Kr matrices were also measured. The direct photodissociative threshold of $CO_2$ to $CO(X\ ^1S^+)+O(^1S)$ in an Ar matrix was found to be 10.6 eV, in agreement with that of the gas phase. Further unambiguous evidence for radiationless, dissociative energy transfer, between the matrix free exciton and $CO_2$, probably by a harpooning mechanism, was seen in Kr:$CO_2$ below the direct photodissociation threshold. Temperature, matrix annealing, and character of the photofragment were found to have significant effects on the rare-gas oxide molecular binding and production rate.

**22748 (ANL—80-126) Workshop on foundations of the relativistic theory of atomic structure.** (Argonne National Lab., IL (USA)). Mar 1981. Contract W-31-109-ENG-38. 310p. (CONF-801255—). NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

The conference is an attempt to gather state-of-the-art information to understand the theory of relativistic atomic structure beyond the framework of the original Dirac theory. Abstracts of twenty articles from the conference were prepared separately for the data base. (GHT)

**22749 (ANL—80-126, pp 1-26) Quantum electrodynamics and the relativistic theory of many-electron atoms.** Sucher, J. (Univ. of Maryland, College Park). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

The development of relativistic theories of many-electron atoms is reviewed, with emphasis on the fact that the Dirac-Coulomb Hamiltonian H/sub DC/ has no bound states. This fact implies that neither the Dirac-Hartree-Fock (DHF) equations nor the DHF wavefunction chi have a simple theoretical interpretation. A no-pair hamiltonian H/sub +/ is defined which does not have the fatal flaw of H/sub DC/ and hence can serve as a starting point for a systematic study of relativistic effects in many-electron atoms which can go beyond central-field approximations. H/sub +/ differs from H/sub DC/ by the presence of external-field positive-energy projection operators in the electron-electron interaction terms. Unlike H/sub DC/, H/sub +/ and its eigenfunctions psi have a clear-cut field-theoretic meaning, which is described. Similar remarks hold for a simpler no-pair Hamiltonian h/sub +/, which involves free positive-energy projection operators and for related Hamiltonians H/sub +/' and h/sup +/' which include the Breit operator. Relativistic Hartree-Fock equations are obtained from H/sub +/ and the relation between their solutions psi and the DHF solutions chi is discussed. The DHF equations may be reinterpreted as approximations to the new HF-type equations; this provides a rationale for their success in applications. It is argued that the Breit operator ought to be included even in the original DHF equations.

**22750** (ANL—80-126, pp 27-44) **Derivation of a configuration space Hamiltonian for heavy atoms: three body potentials.** Mittleman, M.H. (City Univ. of New York, NY). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

A brief history of the difficulties associated with the derivation of a configuration space Hamiltonian is presented. One of the problems encountered is the definition of the projection operators which must occur. A variational definition is obtained and, with simplifying assumptions, the optimum projection operators are those which project onto Hartree-Fock orbitals. This puts many previously performed numerical calculations on a firm footing. The form of the two body interactions is discussed in the context of the gauge freedom. The Coulomb gauge is the favored one but it is pointed out that it has never been proven to be the best one. Finally a form for the relativistic three election potential is given and the possibility of its observation is discussed.

**22751** (ANL—80-126, pp 45-68) **Quantum electrodynamics of high-Z few-electron atoms.** Mohr, P.J. (Yale Univ., New Haven, CT). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

A relatively new area in the field of Atomic Physics and Quantum Electrodynamics (QED) is the precise theoretical and experimental study of high-Z few-electron atoms. Comparison of theory and experiment for the transition rates and energy splittings of these systems provides a fundamental test of the theory of strongly bound electrons. This reviews the quantum electrodynamics of high-Z few-electron atoms based on perturbation theory in the Furry bound interaction picture. A complete overview of the theory is given, from the basic equations to the numerical results for the energy splittings, with attention focused on the Lamb shift in two-electron atoms as an example.

**22752** (ANL—80-126, pp 69-77) **Calculations of relativistic effects in atoms and molecules from the Schroedinger wave function.** Detrich, J.H. (SEI Information Tech., Chicago, IL); Roothaan, C.C.J. Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

The traditional method for dealing with relativistic effects in atoms and molecules consists of a somewhat heuristic combination of quantum electrodynamics and a many-electron quantum mechanics generalized from the one-electron Dirac theory. On the whole, results calculated from this theory agree with experimental data. Nevertheless, the theory is by no means entirely satisfactory; in its development, certain ambiguities and divergencies must be resolved by somewhat arbitrary and/or questionable means. This paper illuminates - and sidesteps - some of the more questionable aspects of the traditional method, by reformulating electromagnetic interactions between particles in a different way.

**22753** (ANL—80-126, pp 78-93) **State-of-the-art for multiconfiguration Dirac-Fock calculations.** Desclaux, J.P. (Centre d'Etudes Nucleaires, Grenoble, France). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

The approximations involved in almost all relativistic calculations are analyzed and one of the most advanced methods, the multiconfiguration Dirac-Fock (MCDF) one, available to carry out high quality atomic calculations for bound states is discussed.

**22754** (ANL—80-126, pp 94-114) **Review of many-body calculations.** Kelly, H.P. (Univ. of Virginia, Charlottesville). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

A brief review is given of many-body perturbation theory and its application to atomic physics. Particular attention is given to the choice of single-particle potential used to generate excited states. Applications to many atomic properties are discussed including hyperfine structure, photoabsorption including multiple processes, and parity non-conserving transitions in heavy atoms.

**22755** (ANL—80-126, pp 115-132) **Atomic structure calculations using the relativistic random phase approximation.** Cheng, K.T. (Argonne National Lab., IL); Johnson, W.R. Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

A brief review is given for the relativistic random phase approximation (RRPA) applied to atomic transition problems. Selected examples of RRPA calculations on discrete excitations and photoionization are given to illustrate the need of relativistic many-body theories in dealing with atomic processes where both relativity and correlation are important.

**22756** (ANL—80-126, pp 133-139) **Application of discrete basis set methods to the Dirac equation.** Drake, G.W.F. (Univ. of Windsor, Ontario). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

The basis sets described provide a convenient method for the direct relativistic calculation of a wide variety of atomic properties. Results have been obtained for the ground state polarizability, and the 2s/sub 1/2/-1s/sub 1/2/ two-photon transition rate of hydrogenic ions. The latter calculation includes all retardation effects and contributions from higher photon multipoles. (GHT)

**22757** (ANL—80-126, pp 140-148) **Are we ready to test QED in two-electron ions.** Ermolaev, A.M. (Univ. of Durham, England). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

The great improvement on the accuracy of the measured transition intervals in two-electron ions achieved recently is discussed with reference to reports of Berry (ANL) and Silver (Oxford) on the precision determination of the 2s $^3S_1$ - 2p $^3$P/sub J/, J = 0, and 2, intervals in the ions with intermediate Z.

**22758** (ANL—80-126, pp 149-151) **Correlation and relativistic effects in hole states.** Fischer, C.F. (Vanderbilt Univ., Nashville, TN). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

The MCHF procedure was used recently to investigate the $1s^-3s^-{}^1S$ and $^3S$ separation in $Ar^{+2}$. The MCHF77 program has been modified to include certain relativistic effects such as the mass correction, Darwin term and spin-spin contact term that are LS dependent, though these corrections are added only to the diagonal energies of an interaction matrix. Hartree-Fock calculations were performed for each of the $^1S$ and $^3S$ states. Then, with the results of the $^3S$ case as initial estimates, calculations were also performed a two-configuration $[1s^-3s^-,3s^{-2}]$ MCHF approximation. The results are reported.

**22759** (ANL—80-126, pp 152-165) **Relativistic many-body theory of atomic transitions: the relativistic equation-of-motion approach.** Huang, K.N. (Univ. of Notre Dame, IN). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

An equation-of-motion approach is used to develop the relativistic many-body theory of atomic transitions. The relativistic equations of motion for transition matrices are formulated using techniques of quantum field theory. To reduce the equation of motion to a tractable form which is appropriate for numerical calculations, a graphical method is employed to resolve the complication arising from the antisymmetrization and angular momentum coupling. The relativistic equation-of-motion method allows an ab initio treatment of correlation and relativistic effects in both closed- and open-shell many-body systems. A special case of the present formulation reduces to the relativistic random-phase approximation.

**22760** (ANL—80-126, pp 166-170) **Correlation corrections to energy levels of Fe XXI.** Weiss, A.W. (National Bureau of Standards, Washington, DC). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

It is necessary to properly account for relativistic effects in order to predict accurately the energy levels of highly ionized atoms, and recently Desclaux, Cheng, and Kim have also demonstrated the importance of term dependent Breit corrections as well as Lamb shifts. For carbon-like iron, $Fe^{+20}$, these corrections led to relative shifts of 2000 to 12,000 $cm^{-1}$ in the excitation energies within the n = 2 complex. These calculations utilized the multiconfiguration Dirac-Fock method (MCDF) and included, for the even parity states, the configuration interaction $2s^22p^2 + 2p^4$. While this certainly accounts for the dominant correlation corrections, the residual L-shell correlation for such a system can easily be of the order of several eV. The results of an attempt to use nonrelativistic correlation information to derive the residual correlation corrections to relativistic energy level calculations are presented.

**22761** (ANL—80-126, pp 171-194) **Precision determinations of high Z hydrogenic ion Lamb shifts.** Murnick, D.E. (Bell Labs., Murray Hill, NJ). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

Precision laser resonance experiments to determine high Z hydrogenic ion Lamb shifts have been reported or are underway on the systems $F^{8+}$, $P^{14+}$, $S^{15+}$ and $Cl^{16+}$. The Bell Labs $Cl^{16+}$ experiment at Brookhaven will be described with emphasis on features common to all measurements. Limits on precision will be described and the study of possible systematic errors engendered by the use of a high power laser intersecting with a relativistic particle beam discussed. The outlook for higher Z measurements with laser spectroscopy or other techniques is also considered.

**22762** (ANL—80-126, pp 195-214) **Energy levels of highly ionized atoms.** Martin, W.C. (National Bureau of Standards, Washington, DC). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

Most of the data reviewed here were derived from spectra photographed in the wavelength range from 600 A down to about 20 A (~ 20 to 600 eV). Measurements with uncertainties less than 0.001 A relative to appropriate standard wavelengths can be made with high-resolution diffraction-grating spectroscopy over most of the vacuum-ultraviolet region. Although this uncertainty corresponds to relative errors of 1 part per million (ppM) at 1000 A and 20 ppM at 50 A, measurements with uncertainties smaller than 0.001 A would generally require more effort at the shorter wavelengths, mainly because of the sparsity of accurate standards. Even where sufficiently numerous and accurate standards are available, the accuracy of measurements of the spectra of very high temperature plasmas is limited by Doppler broadening and, in some cases, other plasma effects. Several sources of error combine to give total estimated errors ranging from 10 to 1000 ppM for the experimental wavelengths of interest here. It will be seen, however, that with the possible exception of a few fine-structure splittings the experimental errors are small compared to the errors of the relevant theoretical calculations.

**22763** (ANL—80-126, pp 215-235) **Inner shell energies: experimental problems.** Deslattes, R.D. (National Science Foundation, Washington, DC); Kessler, E.G. Jr. Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

Progress in theoretical estimates of single vacancy atomic term values has challenged available experimental data. This brief survey of the experimental situation indicates both conceptual and technical problems which are currently faced. Although these interpretational difficulties are formidable, the emergence of systematic trends in the comparison of theory and experiment appears to invite a simple explication.

**22764** (ANL—80-126, pp 236-239) **Beam-foil observation of $1s2s^3S$ - $1s2p^3P$ transitions in helium-like $Fe^{24+}$.** Buchet, J.P.; Buchet-Poulizac, M.C.; Ceyzeriat, P.; Denis, A.; Desesquelles, J.; Druetta, M.; Cong, K.T. (Univ. de Lyon, Villeurbanne, France). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

The measurements of the $\Delta n = 0$ transition energies can lead to sensitive testing of quantum electrodynamics and relativistic corrections for higher Z two-electron ions. A high precision (better than 0.10 A) measurement of $2s^3S$ - $2p^3P$ transitions in $Fe^{24+}$ is reported.

**22765** (ANL—80-126, pp 240-259) **Recent results in $\Delta n = 0$, $n = 2$ transitions of helium-like systems.** DeSerio, R.; Berry, H.G.; Brooks, R.L. (Argonne National Lab., IL). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

Wavelength measurements of the transitions $1s2s\ ^3S_1$ - $1s2p\ ^3P_{0,2}$ of the helium-like ions of silicon, sulfur and chlorine are presented. The wavelengths of these transitions have been calculated for Z = 2 to 50 using a non-relativistic 1/Z expansion, one-electron Dirac energies, plus relativistic corrections in first-order perturbation theory, plus one-electron Q.E.D. or Lamb-shift corrections. By comparisons of measurements of Z = 4 to 26 and theory, a discrepancy is found which is approximately 0.015 $Z^3$ $cm^{-1}$. This can arise from the first-order screening correction to the one-electron Lamb shift and an ab initio estimate of the correction is given.

**22766** (ANL—80-126, pp 260-271) **Summary of QED session.** Armstrong, L. Jr. (Johns Hopkins Univ., Baltimore, MD). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

One of the reasons that it is difficult to make a position space Hamiltonian formulation of the relativistic many electron problem is that the Dirac equation does not contain all of the necessary information required to understand the one electron problem. Dirac also had to explain - in words, not equations - that the vacuum state corresponded to all of the negative energy states being filled. This explained why electrons in positive energy states did not give off photons of $h\nu \sim 2mc^2$ and drop into a negative energy state. When QED was developed to study electromagnetic interactions between electrons, etc., this information of Diracs was included in the formulation through the definition of the electron propagator. QED, however, uses the S matrix, which may not be the most desirable formulation to use in atomic physics. A review of the QED representation is given here.

**22767** (ANL—80-126, pp 272-285) **Review of atomic structure calculations.** Weiss, A.W. (National Bureau of Standards, Washington, DC). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

Over the past several decades, the central problem for ab initio theories of atomic structure has been the proper, or adequate, treatment of electron correlation. For the non-relativistic case, considerable progress has been made in developing methods for treating correlation, and theory has been able to address a broad range of problems in atomic structure. More recently, we have witnessed a great increase in relativistic calculations of atomic structure with applications to those systems where it is essential to properly account for the effects of relativity. The purpose of this paper is to sketch out the principal methods for calculating atomic structures, relativistically and non-relativistically; briefly highlight their similarities and differences; and discuss some prospects for further developments.

**22768** (ANL—80-126, pp 286-300) **Summary on experiments.** Livingston, A.E. (Univ. of Notre Dame, IN). Mar 1981. NTIS, PC A14/MF A01.

From Workshop on foundations of the relativistic theory of atomic structure; Argonne, IL, USA (4 Dec 1980).

Experimental studies of the atomic structures of both simple and complex atoms and ions provide crucial tests of atomic structure theory and of calculational techniques for a wide range of atomic systems. This summary is restricted to a brief discussion of some recent and current experiments in few-electron and many-electron atoms and ions which represent exciting challenges to sophisticated atomic structure calculations, discussed elsewhere. In particular the emphasis is on high-Z systems.

**22769 (CONF-810432—3) Charge transfer to the continuum by heavy ions in atomic hydrogen.** Sellin, I.A. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01.

From Atomic physic program contractors' workshop; Argonne, IL, USA (1 Apr 1981).

Design and installation of an atomic hydrogen target for measurements of charge transfer to the continuum by heavy ions are discussed. The design consists of a tungsten gas cell operated at temperatures of 2500 to 2600°K. Initial testing is underway. (GHT)

**22770 (CONF-810432—4) Atomic physics of strongly correlated systems.** Lin, C.D. (Kansas State Univ., Manhattan (USA)). 1981. Contract AC02-79ER10514. 3p. NTIS, PC A02/MF A01.

From Atomic physic program contractors' workshop; Argonne, IL, USA (1 Apr 1981).

Theoretical studies of electron correlations of doubly excited electrons in hyperspherical coordinates, and differential and total electron transfer cross sections in fast ion-atom collisions are reported. (GHT)

**22771 (DOE/DP/40017—T1) Theoretical investigation and calculation of certain atomic and molecular processes important in the formation and destruction of excited stable gas molecules (or excimers). Final report, October 1, 1978-November 30, 1979.** Flannery, M.R. (Georgia Inst. of Tech., Atlanta (USA). School of Physics). 1979. Contract AS05-76DP40017. 8p. NTIS, PC A02/MF A01.

Progress is reported in the following areas: (a) atomic and molecular collision processes in rare-gas-halide lasers and rare-gas excimer lasers; (b) semiquantal treatment of excited-atom-excited-atom collisions; (c) systematic trends in the inelastic cross sections and form factors for $nl \rightarrow n'l'$ direct collisional transitions; (d) multistate semiclassical orbital treatment of $Li^+$-$H_2$ and $H^+$-$H_2$ collisions; and (e) elastic scattering and rotational excitation in ion-molecule collisions ($Li^+$-$H_2$ and $H^+$-$H_2$ collisions).

**22772 (DOE/ER/04974—T1) Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981.** Greene, E.F. (Brown Univ., Providence, RI (USA)). Mar 1981. Contract AS02-78ER04974. 11p. (COO—4974-3). NTIS, PC A02/MF A01.

An improved apparatus has been designed and constructed to measure the angular distribution of rare gas atoms scattered elastically, or nearly elastically, from the surfaces of crystals. The yields of ions produced when neutral beams of Li, Na, K and Tl hit surfaces of Si (III) or Pt are recorded as they vary with the temperatures of the surfaces. The ions are identified by mass spectroscopy and the surface cleanliness monitored by Auger measurements. Reactions can be activated when fast beams of molecules hit a stationary surface. Above a threshold in kinetic energy beams of $W(CO)_6$ leave a nonvolatile deposit of decomposition products on a glass surface. Raman spectra of these deposits show bands in the carbonyl and metal-carbon stretching regions. Similar experiments with beams of paraldehyde show it decomposes to acetaldehyde in one energetic collision.

**22773 (DOE/ER/10749—1) Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981.** Lieber, M.; Chan, F.T. (Arkansas Univ., Fayetteville (USA). Dept. of Physics). Apr 1981. Contract AS05-80ER10749. 104p. NTIS, PC A06/MF A01.

The eikonal approximation has been recently shown to be of significant utility in the study of electron capture cross sections for energetic ion-atom collisions. The method generally gives much better agreement with available experimental data than does the simple OBK approximation without substantially increasing the difficulty of computation. In the present work, the total cross section is computed for electron capture into an arbitrary nl subshell of $H^+$, $C^{+6}$, $O^{+8}$, and $Fe^{+24}$ ions from ground state hydrogen atoms, at energies of 40 to 200 keV/nuclear (30 to 100 keV in the $H^+$ case). These species were selected because of their importance in fusion studies. Interesting variations with l were obtained. Cross sections for capture into an arbitrary final n-shell, or into all final bound states were also obtained. An analytical closed form expression is derived for electron capture from an arbitrary initial nlm state to an arbitrary final n'l'm' state of a hydrogenic target. Numerical results are presented for all $n' = 2,3$ final states in hydrogen, which may be subjected to experimental test in the near future. Extension of the eikonal method to multielectron targets was studied. There are ambiguities in the method requiring further analysis. Agreement with experimental data is nevertheless satisfactory, but the high energy results are suspect.

**22774 (DOE/EV/72005—T2) Measurement of pair interactions in neodymium ethyl sulfate.** King, A.R.; Jeffries, C.D. (California Univ., Berkeley (USA). Dept. of Physics). Aug 1970. Contract AT03-76EV72005. 23p. NTIS, PC A02/MF A01.

The EPR spectrum of single ions of $^{143}Nd$ in a crystal of Neodymium Ethyl Sulfate, predominantly of isotope $^{142}Nd$, was observed under condition of very high Boltzmann factor, i.e., high fields and low temperatures. It was found that the interactions with neighboring ions displaced the hyperfine lines from uniform spacing, and that by measuring the deviation it was possible to find the nearest neighbor interaction. The departure from a purely magnetic dipolar interaction is smaller than previous measurements would indicate. It was found that EPR resonance at large values of H/T in magnetically concentrated crystals can yield accurate values of spin-spin interactions.

**22775 (LA-UR—81-1157) Self-focusing in $SF_6$.** Ackerhalt, J.R.; Galbraith, H.W. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 7p. (CONF-810429—15). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

It is shown by explicit calculation of previously published quasicontinuum model that the molecular susceptibility rapidly approaches zero as higher excited states of the molecule become populated. Hence the overtones of the $\nu_3$-pumped mode are totally responsible for the self focusing effects in $SF_6$. The $\nu_3$ ladder contribution to the susceptibility is calculated. The vibrational model is a classical triply degenerate anharmonic oscillator in the Cartesian basis with the anharmonicity parameters chosen to be consistent with the latest spectroscopic analysis of the $3\nu_3$ overtone spectrum. The rotational structure is represented by a distribution of these oscillators where the distribution is chosen to correspond to the spectrum of the $\nu_3$ fundamental. Good agreement is found with the 300° in self-focusing data of Nowak and Ham at $CO_2$ P(28), P(20) and P(10) in $SF_6$.

**22776 (LA-UR—81-1228) Stimulated Raman scattering and four-wave mixing: steady-state plane-wave analytic solutions.** Ackerhalt, J.R. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 8p. (CONF-810429—22). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

The equations for plane-wave steady-state propagation of n fields interacting via four wave processes in a Raman medium have been known since at least 1962. Complete analytic solutions have only been found for the process of harmonic generation. However, solutions have been obtained in the gain regime assuming zero pump depletion. Assuming all fields satisfy the phase matching condition, general analytic solutions to these equations have been found. The solutions are complete in that they describe both pump depletion and saturation. Some example problems will be studied.

**22777 (LBL—12157) Recent developments and applications of multi-configuration Hartree-Fock methods. NRCC proceedings No. 10.** Dupuis, M. (ed.). (Lawrence Berkeley Lab., CA (USA)). Feb 1981. Contract W-7405-ENG-48. 179p. (CONF-800726—). NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

Twenty-seven papers are included in four sessions titled: generalized Fock operator methods, annihilation of single excitations methods, second-order MCSCF methods, and applications of

MCHF methods. Separate abstracts were prepared for eight papers; one of the remaining had been previously abstracted. (DLC)

22778 (LBL—12157, pp 10-13) **Quadratically convergent MCSCF theory for large configuration sets.** Das, G. (Argonne National Lab., IL). Feb 1981. NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

A multi-configuration self-consistent field method for large configuration-sets is presented. It consists in identifying a primary subset containing the predominant configurations and a secondary one containing the rest. The formalism achieves near-quadratic convergence as well as a significant simplification of the orbital-transformation problem by the introduction of Fock equations and Fock matrices.

22779 (LBL—12157, pp 23-26) **Loop-driven graphical unitary group approach applied to the MCSCF problem.** Laidig, W.D. (Univ. of California, Berkeley); Schaefer, H.F. III. Feb 1981. NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

A two-step MCSCF procedure was developed based on the LDGUGA formalism. In one iteration the first step would be a CI calculation in which the orbitals were fixed. This is followed by a computation to determine how the orbitals should be changed to minimize the total energy. In this second step the orbitals vary but the expansion coefficients are frozen. The integrals are then transformed to the new orbital basis and we iterate until the changes in the orbitals and the expansion coefficients are suitably small. In computing the orbital changes the two-particle density matrix and the transformed integrals are needed. The ability to generate the two-particle density matrix rapidly is a key feature in our method.

22780 (LBL—12157, pp 31-50) **Generalized molecular orbital theory: a limited multiconfiguration self-consistent-field-theory.** Hall, M.B. (Texas A and M Univ., College Station). Feb 1981. NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

The generalized molecular orbital (GMO) approach is a limited type of multiconfiguration self-consistent-field (MCSCF) calculation which divides the orbitals of a closed shell molecule into four shells: doubly occupied, strongly occupied, weakly occupied, and unoccupied. The orbitals within each shell have the same occupation number and are associated with the same Fock operator. Thus, the orbital optimization is ideally suited to solution via a coupling operator. The determination of the orbitals is followed by a configuration interaction (CI) calculation within the strongly and weakly occupied shells. Results for $BH_3$ show a striking similarity between the GMO's and the natural orbitals (NO's) from an all singles and doubles CI calculation. Although the GMO approach would not be accurate for an entire potential surface, results for spectroscopic constants of $N_2$ show that it is suitable near the equilibrium geometry. This paper describes the use of the GMO technique to determine the primary orbital space, but a potentially important application may be in the determination of a secondary orbital space following a more accurate MCSCF determination of the primary space.

22781 (LBL—12157, pp 51-57) **MCSCF optimization through iterative CI calculations in the single excitation space and MCSCF wave functions in the full reaction space.** Ruedenberg, K. (Ames Lab., IA). Feb 1981. NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

This paper is divided into 5 parts: optimal space and configuration space, variational conditions, optimization procedure, the ALIS procedure for ab initio quantum chemical calculations, and the method of the Full Optimized Reaction Space (FORS). (DLC)

22782 (LBL—12157, pp 71-72) **Super-CI MCHF program in ALCHEMY.** Dupuis, M. (Lawrence Berkeley Lab., CA); Liu, B. Feb 1981. NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

A computer code is described which is used for the calculation of multiconfiguration Hartree-Fock wavefunctions, and is available in the ALCHEMY set of programs. It is routinely used for problems involving up to 100 CSF's. (DLC)

22783 (LBL—12157, pp 77-111) **General quadratically convergent MCSCF theory in terms of reduced matrix elements.** Roothaan, C.C.J. (Univ. of Chicago, IL); Detrich, J.H. Feb 1981. NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

An improved scheme is presented for calculating multi-configuration self-consistent field wave functions of electronic systems for which the symmetry group is simply reducible. Our formulation is based on expansion of the orbitals in a basis set, but is otherwise entirely general. The MCSCF equations are derived from a multistate variation principle. In the algebraic development extensive use is made of shell and term replacement operators, permitting a transparent formal development in which symmetry properties are fully exploited. The resulting scheme is manifestly quadratically convergent in the general case. Sufficient detail is presented to provide the basis for efficient computer implementation.

22784 (LBL—12157, pp 117-120) **Recent developments in multiconfiguration wavefunction optimization.** Shepard, R. (Battelle Columbus Labs., OH). Feb 1981. NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

A formal and numerical comparison of two of the most promising types of multiconfiguration wavefunction optimization methods, the super-CI methods and the exponential operator methods, is performed. The super-CI methods display superior convergence properties when the initial wavefunction is far from correct while the exponential operator methods possess superior convergence characteristics when the initial wavefunction is close to correct. The formal comparison of these approaches suggests hybrid methods which have some of the advantages of both methods. Unitary group methods have been successfully employed in the implementation of a general and efficient multiconfiguration wavefunction optimization program using these exponential operator and hybrid methods and a discussion of this impiementation is included.

22785 (LBL—12157, pp 121-122) **Formal and numerical convergence comparison of SCI and exponential methods.** Shepard, R. (Battelle Memorial Inst., Columbus, OH); Simons, J. Feb 1981. NTIS, PC A09/MF A01.

From MCHF workshop; College Station, TX, USA (14 Jul 1980).

An examination of the forms used to describe modifications in the orbital and configuration expansion coefficients, the energy functions which are made stationary, the resultant equations to be solved, and the iterative procedures which are commonly employed in solving such equations, shows the similarities and differences among the super CI(SCI) and exponential MCSCF methods.

22786 **(LBL—12626) Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers.** Dai, H.L. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 236p. NTIS, PC A11/MF A01.

Multiphoton dissociation (MPD) of ethyl chloride was studied using a tunable 3.3 $\mu$m laser to excite CH stretches. The absorbed energy increases almost linearly with fluence, while for 10 $\mu$m excitation there is substantial saturation. Much higher dissociation yields were observed for 3.3 $\mu$m excitation than for 10 $\mu$m excitation, reflecting bottlenecking in the discrete region of 10 $\mu$m excitation. The resonant nature of the excitation allows the rate equations description for transitions in the quasicontinuum and continuum to be extended to the discrete levels. Absorption cross sections are estimated from ordinary ir spectra. A set of cross sections which is constant or slowly decreasing with increasing vibrational excitation gives good fits to both absorption and dissociation yield data. The rate equations model was also used to quantitatively calculate the pressure dependence of the MPD yield of $SF_6$ caused by vibrational self-quenching. Between 1000-3000 $cm^{-1}$ of energy is re-

moved from $SF_6$ excited to $\sim > 60$ kcal/mole by collision with a cold $SF_6$ molecule at gas kinetic rate. Calculation showed the fluence dependence of dissociation varies strongly with the gas pressure. Infrared multiphoton excitation was applied to study thermal unimolecular reactions. With $SiF_4$ as absorbing gas for the $CO_2$ laser pulse, transient high temperature pulses were generated in a gas mixture. IR fluorescence from the medium reflected the decay of the temperature. The activation energy and the preexponential factor of the reactant dissociation were obtained from a phenomenological model calculation. Results are presented in detail. (WHK)

22787 **(SAND—81-0203C) Nuclear microprobe analysis.** Doyle, B.L.; Wing, N.D.; Peercy, P.S. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 24p. (CONF-810705—1). NTIS, PC A02/MF A01.

From 16. annual conference of the Microbeam Analysis Society; Vail, CO, USA (13 Jul 1981).

Many of the present ion beam analysis methods are reviewed and Sandia's recently constructed nuclear microprobe and its ancillary computer system are described.

22788 **(UCRL—15327) Pulsed WIP electron gun. Fabrication phase 1 x 40 cm and 1 x 70 cm cooled WIP electron gun. Final report, March 1979-December 1980.** Wakalopulos, G. (Hughes Aircraft Co., Culver City, CA (USA)). 1980. Contract W-7405-ENG-48. 29p. NTIS, PC A03/MF A01.

An electron gun capable of long-run operation at 10 KHz and 1 A/cm$^2$ has been fabricated and tested. Pulse widths of 200 to 600 nsec and a total life of greater than $10^7$ shots have been demonstrated. During the acceptance tests, the electron gun was operated at a total average power of 20 KW for 30 minutes. This basically satisfied the contract requirements. To establish some upper limit of the gun's capability, the device was operated at a repetition rate of 3.5 KHz at a total average power of 54.5 KW for greater than 10 minutes. During these tests, no high voltage breakdown occurred after the device was processed. The beam uniformity at high repetition rates is +-10% and the efficiency is 50%.

22789 **(UCRL—83764) Effect of propagation of coherent pulses on multiple-photon excitation.** Shore, B.W.; Eberly, J.H.; Konopnicki, M.J. (Rochester Univ., NY (USA). Dept. of Physics and Astronomy; California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Feb 1980. Contract W-7405-ENG-48. 26p. (CONF-800614—4). NTIS, PC A03/MF A01.

From 11. international quantum electronics conference; Boston, MA, USA (23 Jun 1980).

The influence of laser pulse propagation on multiple-photon excitation of many-level absorbers, and the significance of SIRF for $SF_6$ dissociation are discussed.

22790 **(UCRL—85577) Molecular potentials and relaxation dynamics.** Karo, A.M. (Lawrence Livermore National Lab., CA (USA)). 27 Mar 1981. Contract W-7405-ENG-48. 47p. (CONF-810442—2). NTIS, PC A03/MF A01.

From Joint workshop on negative ions; Mexico City, Mexico (1 Apr 1981).

The use of empirical pseudopotentials, in evaluating interatomic potentials, provides an inexpensive and convenient method for obtaining highly accurate potential curves and permits the modeling of core-valence correlation, and the inclusion of relativistic effects when these are significant. As an example, recent calculations of the chi$^1\Sigma^+$ and a$^3\Sigma^+$ states of LiH, NaH, KH, RbH, and CsH and the chi$^2\Sigma^+$ states of their anions are discussed. Pseudopotentials, including core polarization terms, have been used to replace the core electrons, and this has been coupled with the development of compact, highly-optimized basis sets for the corresponding one- and two-electron atoms. Comparisons of the neutral potential curves with experiment and other ab initio calculations show good agreement (within 1000 cm$^{-1}$ over most of the potential curves) with the difference curves being considerably more accurate.

22791 **(UCRL—85577(Rev.1)) Molecular potentials and relaxation dynamics.** Karo, A.M. (Lawrence Livermore National Lab., CA (USA)). 18 May 1981. Contract W-7405-ENG-48. 48p. (CONF-810442—2(Rev.1)). NTIS, PC A03/MF A01.

From Joint workshop on negative ions; Mexico City, Mexico (1 Apr 1981).

The use of empirical pseudopotentials, in evaluating interatomic potentials, provides an inexpensive and convenient method for obtaining highly accurate potential curves and permits the modeling of core-valence correlation, and the inclusion of relativistic effects when these are significant. Recent calculations of the $X^1\Sigma^+$ and $a^3\Sigma^+$ states of LiH, NaH, KH, RbH, and CsH and the $X^2\Sigma^+$ states of their anions are discussed. Pseudopotentials, including core polarization terms, have been used to replace the core electrons, and this has been coupled with the development of compact, higly-optimized basis sets for the corresponding one- and two-electron atoms. Comparisons of the neutral potential curves with experiment and other ab initio calculations show good agreement (within 1000 cm$^{-1}$ over most of the potential curves) with the difference curves being considerably more accurate. In the method of computer molecular dynamics, the force acting on each particle is the resultant of all interactions with other atoms in the neighborhood and is obtained as the derivative of an effective many-body potential. Exploiting the pseudopotential approach, in obtaining the appropriate potentials may be very fruitful in the future. In the molecular dynamics example considered here, the conventional sum-of-pairwise-interatomic-potentials (SPP) approximation is used with the potentials derived either from experimental spectroscopic data or from Hartree-Fock calculations. The problem is the collisional de-excitation of vibrationally excited molecular hydrogen at an Fe surface. The calculations have been carried out for an initial vibrotational state v = 8, J = 1 and a translational temperature corresponding to a gas temperature of 500°K. Different angles of approach and different initial random impact points on the surface have been selected. For any given collision with the wall, the molecule may pick up or lose vibrotatonal and translational energy.

22792 **(UCRL—85858) Molecular resonance phenomena.** Hazi, A.U. (Lawrence Livermore National Lab., CA (USA)). 1980. Contract W-7405-ENG-48. 17p. (CONF-8005162—1). NTIS, PC A02/MF A01.

From Workshop on electron-atom and electron-molecule collisions; Bielefeld, F.R. Germany (5 May 1980).

It is attempted to show that the Stieltjes-moment-theory provides a practical and a reasonably accurate method for calculating the widths of molecular resonances. The method seems to possess a number of advantages for molecular applications, since it avoids the explicit construction of continuum wavefunctions. It is very simple to implement the technique numerically, because it requires only existing bound-state electronic structure codes. Through the use of configuration interaction techniques, many-electron correlation and polarization effects can be included in the description of both the resonance and the non-resonant background continuum. To illustrate the utility and the accuracy of the Stieltjes-moment-theory technique, used in conjunction with configuration interaction (CI) wave functions, recent applications to the $^1\Sigma$/sub u/($1\sigma$/sub u/$2\sigma$/sub g/) autoionizing resonance state of $H_2$ and the well known $^2\Pi$/sub g/ state of $N_2^-$ are discussed. The choices of the one-electron basis sets and the types of many-electron configurations appropriate for these two cases are described. Also, guidelines for the selection of the projection operators defining the resonant and non-resonant subspaces in the case of both Feshbach and shape-resonances are given. The numerical results indicate that the Stieltjes-moment-theory technique, which employs $L^2$ basis functions exclusively, produces as accurate resonance parameters as can be extracted from direct electron-molecule scattering calculations, provided approximately the same approximations are used to describe important physical effects such as target polarization. Furthermore the method provides sufficiently accurate fixed-nuclei electronic resonance parameters to be used in ab initio calculation of resonant vibrational excitation cross sections. (WHK)

**22793 Geometry and spectral properties of $Ne^+a$, $Ar^+_3$, $Kr^+_3$, and $Xe^+_3$.** Wadt, W.R. (Mail Stop 569, Group T-12, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). W-4705-ENG. *Applied Physics Letters ;* **38**: No. 12, 1030-1032(15 Jun 1981).

Ab initio polarization configuration interaction (POL-CI) calculations show that $Ne^+_3$ and $Ar^+_3$ are both linear, in agreement with indirect experimental evidence on $Ar^+_3$ and in contradiction to earlier approximate theoretical calculations on $Ar^+_3$ , which predicted an equilateral triangular geometry. The experimentally unknown $Ne^+_3$ dissociation energy is predicted to be 0.15 +- 0.01 eV. Simple diatomics-in-molecules (DIM) calculations were shown to be in very good agreement with the ab initio results. DIM calculations predict that $Kr^+_3$ and $Xe^+_3$ are also linear. All the rare-gas—trimer ions possess at least one very strong absorption band in the visible, even stronger than the near ultraviolet absorption band of the rare-gas—dimer ions.

**22794 Monte Carlo trajectory calculations of the energy of activation for collision-induced dissociation of $H_2$ by Ar as a function of rotational energy.** Blais, N.C.; Truhlar, D.G. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Journal of Chemical Physics, The ;* **74**: No. 12, 6709-6712(15 Jun 1981).

Rate constants and activation energies for selected initial rotational levels, thermally averaged over vibrational states and translational energies, are calculated for $Ar+H_2 \rightarrow Ar+H+H$ by the Monte Carlo quasiclassical trajectory method. The results show that activation energies for high rotational quantum numbers exceed those estimated from centrifugal barrier heights. To characterize the rotational-level model of diatomic dissociation, we tabulate rate constants, activation energies, and other properties of dissociative collisions as functions of initial rotational quantum number j for conditions of thermal vibrational and translational degrees of freedom at 4500 K. Under equilibrium conditions, dissociation from a given j level is shown to occur primarily from the topmost v state of that j level.

**22795 VUV fluorescence following photodissociation of $N_2O$ at 193 nm.** Zavelovich, J.; Rothschild, M.; Gornik, W.; Rhodes, C.K. (Department of Physics, University of Illinois at Chicago Circle, Chicago, Illinois 60680). *Journal of Chemical Physics, The ;* **74**: No. 12, 6787-6791(15 Jun 1981).

Photolytic studies performed at 193 nm demonstrate that NO in the highly excited D(v = 1,5) and E(v = 0) states is generated from $N_2O$ during irradiation in three sequential steps involving photodissociation, chemical reaction, and photoexcitation. The resulting NO fluorescence (160—230 nm) was analyzed with a system of rate equations, and the temporal behavior, intensity dependence, and pressure dependence were found to be consistent with a simple kinetic model. The quenching coefficient of NO by $N_2$, Ar, and $N_2O$ were determined in this analysis to be q2 = (2.7 +- 0.8) x $10^{-11}$ $cm^3$ $sec^{-1}$, q/sub Ar/ = (6.6 +- 1.4) x $10^{-11}$ $cm^3$ $sec^{-1}$, and q2O = (1.5 +- 0.4) x $10^{-10}$ $cm^3$ $sec^{-1}$. Finally, dramatic changes in the spectral distribution of the ultraviolet NO fluorescence due to collisions with He were observed, which contrasts with the absence of spectral redistribution in collisions involving $N_2$, Ar, and $N_2O$.

**22796 Method for nuclear spin statistics in molecular spectroscopy.** Balasubramanian, K. (Department of Chemistry and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics, The ;* **74**: No. 12, 6824-6829(15 Jun 1981).

Using spin projection operator methods, generating functions are developed for nuclear spin species. These operators also generate elegantly the irreducible respresentations spanned by a$_1$/sup b/$_1$ a$_2$/sup b/$_2$xxxa/sub t//sup b//sub t/ nuclear spin functions, where a/sub i/ is the number of possible spin states of the b/sub i/ nuclei of the same kind in the molecule. From these generating functions the statistical weights of the rovibronic levels of any polyatomic molecule can be obtained easily. The method is illustrated with $^{33}SF_6$, $^{13}$C-triphenylene, and triphenylene with protons replaced by D. For $^{13}$C-triphenylene there are 1 073 741 824 nuclear spin functions from which we determined the statistical weights of the rovibronic levels A/sup prime/$_1$, A/sup prime/$_2$, E', A/sup double-prime/$_1$, A/sup double-prime/$_2$, and E" to be 178 940 928, 178 973 696, 357 913 600, 178 940 928, 178 973 696, and 357 913 600, respectively.

**22797 Vibrational relaxation in jet-cooled phenylalkynes.** Powers, D.E.; Hopkins, J.B.; Smalley, R.E. (Rice Quantum Institute and Department of Chemistry, Rice University, Houston, Texas 77001). *Journal of Chemical Physics, The ;* **74**: No. 11, 5971-5976(1 Jun 1981).

Absorption and dispersed fluorescence spectra are reported for a variety of 1-phenylalkynes cooled in a supersonic free jet. The $^1B_2(rr) \leftarrow ^1A_1$ spectra of these compounds is characterized by a near perfect cancellation of transition strength sources for the totally symmetric vibronic bands including the origin. Two skeletal distortion modes are found to dominate the spectra, inducing strong transitions by vibronic coupling to a higher state of $^1A_1$ symmetry. These two modes are rotated in the $^1B_2$ state relative to their configuration in the ground state. The nature of these modes is found to be largely unaffected by changes in the length of the alkyl chain, but vibrational relaxation into the chain still appears to proceed on a subnanosecond time scale.

**22798 Resonance Raman scattering of semiquinone radical anions.** Tripathi, G.N.R. (Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). *Journal of Chemical Physics, The ;* **74**: No. 11, 6044-6049(1 Jun 1981).

The time resolved electronic absorption spectra of p-benzosemiquinone (PBSQ) and 2,5-di-t-butyl-p-benzosemiquinone (DTBSQ) radical anions are obtained in pulse radiolysis. The same radicals have been generated chemically in a flow system. The Raman spectra are excited by tuning a pulsed dye laser in the electronic absorption region. Time adjusted gate electronics have been used for the temporal resolution of the Raman spectra from fluorescence. The resonance effect has been utilized to record the Raman spectra of unstable semiquinone radical anions, $10^{-3}$—$10^{-4}$ M in concentration. The observed Raman spectra and excitation profile are interpreted to assign the electronic and the vibrational transitions in the radicals. The semiquinone radical anions are fairly stable on photoirradiation above 330 nm.

**22799 Laser induced fluorescence studies of UII produced by photoionization of uranium.** Chen, H.; Borzileri, C. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Journal of Chemical Physics, The ;* **74**: No. 11, 6063-6069(1 Jun 1981).

Multiphoton ionization of uranium atoms followed by laser-induced fluorescence detection of uranium ions is used to study the initial electronic state distribution of photon-produced ions and the degree of ionization within the uranium vapor. Our experimental data clearly demonstrate that photoionization of uranium through the 50 701 $cm^{-1}$ excited even levels using a broad band pulsed dye laser of 5915 A produces roughly 50% ground state ions and 50% metastably excited (289 $cm^{-1}$) ions. The effective photoionization cross section is about 4.7 x $10^{-17}$ $cm^2$. The subsequent dispersion of UII after photoionization appears to be caused by ambipolar expansion of ions and electrons in the plasma. The gA values for the 4050 and 3859 A transitions of UII are measured to be 0.86 x $10^8$ and 2.8 x $10^8$ $s^{-1}$, respectively.

**22800 New, optically forbidden Rydberg series in $O_2$ converging to the $O^+_2$ c $^4S^-$/sub u/ limit.** Dillon, M.A.; Spence, D. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics, The ;* **74**: No. 11, 6070-6074(1 Jun 1981).

We have measured the angular dependence of inelastically scattered electrons in $O_2$ in the energy-loss range 16 to 26 eV for incident electron energies between 75 and 400 eV, and for scattering angles between 2° and 12°. For high incident energy and low scattering angle our energy loss spectra correspond to the known optical absorption spectrum. At higher scattering angles, four new structures appear in our spectra at 21.85, 23.30, 23.80, and 24.06 eV. These four structures are the lowest members of the first optically forbidden Rydberg series observed to converge to the $O^+_2$ c $^4S^-$/sub u/ limit at 24.56 eV. The calculated quantum defects for these levels are about 0.75. This value, combined with angular scattering propensity rules, indicates that the new Rydberg states occur by promotion of an electron from the s/sub u/2s orbital to nps/sub u/

orbitals, where n = 3,4,5,6. A consideration of the propensity rules for excitation of forbidden transitions by high energy electron impact suggest the term symbol of the new Rydberg states to be $^3S^-$/sub g/.

22801 **Classical trajectory models for electronically nonadiabatic collision processes: A classical valence bond model for electronic degrees of freedom.** Miller, W.H.; Orel, A.E. (Department of Chemistry and Materials and Molecular Research Division of the Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics, The ;* **74**: No. 11, 6075-6082(1 Jun 1981).

A classical interpretation of the Dirac—Van Vleck spin version of valence bond theory is used to obtain a classical model for electronic degrees of freedom within the valence bond framework. The approach is illustrated by deriving the explicit forms of the classical Hamiltonians, involving electronic and heavy particle degrees of freedom, for the H—$H_2$, F—$H_2$, and O—$H_2$ systems. It is also shown how the initial conditions for both electronic and heavy particle degrees of freedom are chosen to carry out a classical trajectory simulation of collision processes. The attractive feature of this model is that it is as easily applicable to electronically nonadiabatic processes as it is to adiabatic ones.

22802 **Analytic representation of the dipole oscillator-strength distribution.** Dillon, M.A.; Inokuti, M. (Argonne National Laboratory, Argonne, Illinois 60439). W-31-109-ENG-38. *Journal of Chemical Physics, The ;* **74**: No. 11, 6271-6277(1 Jun 1981).

It is possible to represent an essential factor of the dipole oscillator-strength distribution for a single-electron continuum in terms of a compact expression involving a polynomial of several degrees in a suitable variable. The factor, which may be called the reduced oscillator-strength distribution, is defined in terms of the radial dipole matrix element with respect to the final-state wave function normalized in an energy-independent way near the origin. The key variable is g = e/(e+I), where e is the kinetic energy of the ejected electron and I is the ionization threshold energy. The structure of the analytic representation has been identified through a study of the analytic properties of the dipole matrix element as a function of e. For illustration, H, He, Li, and Na atoms are treated explicitly. Implications of our results to molecules and multichannel cases are also indicated. The present findings will be especially useful for interpolation and extrapolation of experimental data.

22803 **Laser fluorescence spectroscopy of sputtered zirconium atoms.** Pellin, M.J.; Wright, R.B.; Gruen, D.M. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). W-31-109-ENG-38. *Journal of Chemical Physics, The ;* **74**: No. 11, 6448-6457(1 Jun 1981).

Doppler shift laser induced fluorescence spectroscopy was used to determine the relative sputtering yields and number density velocity distribution of sputtered neutral ground state zirconium atoms. Neither change in primary ion energy over the range 1—3 keV nor change in primary ion mass ($Ar^+$, $Kr^+$) affected the velocity distribution despite large changes in the sputtering yield. The measured number density velocity distributions n(v) are well explained by standard linear collision cascade theory and follow the expression n(v)dv a $[v^2/(v^2+v^2$/sub b/$)^3]$dv, where v/sub b/ is the velocity corresponding to a surface binding energy, E/sub b/ = 1/2m/sub Zr/$v^2$/sub b/, with E/sub b/ = 6.305 eV, the bulk zirconium sublimation energy. Surprisingly, the number density velocity distributions of zirconium atoms sputtered in two excited states (a $^3F$/sub 3,4/) are indistinquishable from that measured for ground state zirconium atoms. Further, the sputtering yield dependence on primary ion energy for the $^3F$/sub 3,4/ was also, within experimental error, the same as for the $^3F_2$ ground state zirconium. The sputtering yield for the two excited states represents almot 40% of the total yield of zirconium. Evaluation of the results incorporates for the first time the effects of power broadening, transit time broadening, and velocity dependent fluorescent detection efficiencies.

22804 **Application of dimensional regularization to single chain polymer static properties: Conformational space renormalization of polymers. III.** Oono, Y.; Ohta, T.; Freed, K.F. (The James Franck Institute and The Department of Chemistry, The University of Chicago, Chicago, Illinois 60637). *Journal of Chemical Physics, The ;* **74**: No. 11, 6458-6466(1 Jun 1981).

A dimensional regularization approach to the renormalization group treatment of polymer excluded volume is formulated in chain conformation space where monomers are specified by their spatial positions and their positions along the chain and the polymers may be taken to be monodisperse. The method utilizes basic scale invariance considerations. First, it is recognized that long wavelength macroscopic descriptions must be well defined in the limit that the minimum atomic or molecular scale L is set to zero. Secondly, the microscopic theory is independent of the conveniently chosen macroscopic scale of length k. The freedom of choice of k is exploited along with the assumed renormalizability of the theory to provide the renormalization group equations which directly imply the universal scaling laws for macroscopic properties. The renormalizability of the model implies the existence of the general relations between the basic macroparameters, such as chain length, excluded volume, etc., and their microscopic counterparts in the microscopic model for the system. These macro—micro relations are defined through the condition that macroscopic quantities be well defined for polymer chains for any spatial dimensionality. The method is illustrated by calculating the end vector distribution function for all values of end vectors R. The evaluation of this distribution function currently requires the use of expansions in e = 4-d. In this case our distribution reduces to known limits for R→0 or ∞. Subsequent papers will present calculations of the polymer coherent scattering function, the monomer spatial distribution function, and concentration dependent properties.

22805 **Doppler-canceled, two-photon resonant ionization spectroscopy.** Bushaw, B.A.; Whitaker, T.J. (Batelle Pacific Northwest Laboratories, Richland, Washington 99352). *Journal of Chemical Physics, The ;* **74**: No. 11, 6519-6520(1 Jun 1981).

The use of a pulse amplified cw dye laser is described in the first observation of hyperfine structure in the two-photon resonant, three-photon ionization spectrum of ground state Xe. (AIP).

22806 **Simulation of slow cyclotron wave growth on a scattered relativistic electron beam.** Shanahan, W.R.; Faehl, R.J. (Los Almos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Physics of Fluids ;* **24**: No. 6, 1207-1209(Jun 1981).

Simulations demonstrating effective growth of slow cyclotron waves on a beam exhibiting a scattered distribution of particle velocities are described. No dramatic changes from the cold beam results for the dispersive properties are observed, but significant modifications of radial eigenmode structure appear.

22807 **Vacuum UV and soft x-ray optical emissions from electron impact on metals.** Hughes, R.H.; Heumier, T.A.; Griffin, P.M. (University of Arkansas, Physics Department, Fayetteville, Arkansas 72701). W-7405-ENG-26. *Applied Optics ;* **20**: No. 8, 1350-1354(15 Apr 1981).

Spectrograms from 2200 to 20 A of optical emissions produced by a simple lamp using fast (3—10-keV) electron impact on tungsten and tantalum targets are presented. The lamp dissipated up to 5 kW/$cm^2$ on the target surface, simultaneously cleaning the surface and generating bremsstrahlung in the soft x-ray region with 3-keV electron impact and longer wavelength transition radiation at the higher energy. In both the bremsstrahlung and transition radiation modes, the lamp emissions were of sufficient strength and reproducibility to qualify the two mechanisms as potential processes for use in a secondary standard light source. Calculated spectral distributions of transition radiation for normally incident electrons on tungsten, tantalum, and aluminum targets, with a viewing direction 45° from the normal, are also shown.

**22808 Ab initio study of dissociative attachment of low-energy electrons to $F_2$.** Hazi, A.U.; Orel, A.E.; Rescigno, T.N. (Theoretical Atomic and Molecular Physics Group, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). W-7405-ENG-48. *Physical Review Letters ;* **46**: No. 14, 918-922(6 Apr 1981).

Adiabatic-nuclei resonance theory has been applied to the study of dissociative attachment of low-energy electrons to $F_2$. Stieltjes moment theory was used to derive fixed-nuclei electronic resonance parameters from large scale configuration-interaction calculations on $F_2$ and $F_2^-$. Dissociative attachment cross sections are reported for the four lowest vibrational levels of $F_2$ and compared to available experimental data.

**22809 Ion beam characteristics of a gas-filled accelerator tube.** Berg, R.S.; Bickes, R.W. Jr.; Boers, J.E.; Shope, L.A. (Neutron Devices and Technology Department, 2350 Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 983-986(Apr 1981).

A gas-filled tube used to produce a pulsed neutron flux with the D(T,$He^4$)n reaction is described. Deuterium and tritium ions generated in a reflex discharge are extracted and accelerated to 100 keV by means of an accelerator electrode onto a deutero—tritide target electrode. The electrodes are designed to focus the ion beam onto the target. Total tube currents consisting of extracted ions, unsuppressed secondary electrons, and ions generated by interactions with the background gas are typically 100 mA. Characteristics of the extracted ion beam are discussed. Accelerating voltages greater than 50 keV are required to focus the beam through the accelerator aperture for configurations that give beams with the proper energy density at the target. The perveance of the beam is defined. Maximum perveance values are 2—10 nanopervs. Tube focussing and neutron production characteristics are described.

**22810 Parabolic tunneling calculations.** Skodje, R.T.; Truhlar, D.G. (Univ. of Minnesota, Minneapolis). Contract AC02-79ER10425. *Journal of Physical Chemistry, The ;* **85**: No. 6, 624-628(19 Mar 1981).

A new analytic approximation is presented for thermally averaged transmission coefficients for tunneling through and reflection by truncated parabolic potential barriers. The approximation has a wide range of validity and avoids the spurious singularities of the well-known result for untruncated parabolic barriers. The analytic result is also applied to effective parabolic fits to other barrier shapes. The results are quite encouraging and suggest that the approximation may be useful for a wide variety of chemical applications.

**22811 Multistep laser photoionization of the lanthanides and actinides.** Worden, E.F.; Conway, J.G. (Univ. of California, Livermore). Contract W-7405-ENG-48. *ACS (American Chemical Society) Symposium Series ;* No. 131, 381-425(1980). (CONF-790917—P4).

From American Chemical Society national meeting; Washington, DC, USA (10 Sep 1979).

Techniques of stepwise laser excitation and photoionization have been applied to study spectroscopic properties of neutral atoms of lanthanides and actinides. The spectroscopic properties that can be determined include: ionization potential, energy levels, isotope shifts, hyperfine structure, lifetimes of energy levels, branching ratios and oscillator strengths. We discuss the laser methods used to obtain these properties (with emphasis on ionization potentials) and give examples of results obtained for each. The ionization potentials obtained by laser technique are in eV: Ce, 5.5387(4); Pr, 5.464(12); Nd, 5.5250(6); Sm, 5.6437(6); Eu, 5.6704(3); Gd, 6.1502(6), Tb, 5.8639(6); Dy, 5.9390(6); Ho, 6.0216(6); Er, 6.1077(10); U, 6.1941(5) and Np, 6.2657(6). Regularities in the f/sup N/$s^2$ - f/sup N/s ionization limits for the lanthanides have been found as a result of these accurate values and previously known accurate values for the others. Multistep photoionization has been employed for laser isotope separation and for studies of autoionization. 75 references, 16 figures, 7 tables.

## 6404 Fluid Physics

*REFER ALSO TO CITATION(S) 22152*

**22812 Theory of the Stern—Volmer coefficient for dense fluids.** Baird, J.K.; McCaskill, J.S.; March, N.H. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Chemical Physics, The ;* **74**: No. 12, 6812-6816(15 Jun 1981).

In phenomenological theories of fluorescence quenching in dense fluids, one assumes that the Stern—Volmer coefficient K has a dependence upon a limited number of parameters. Denoting by $K^0$ the value of K when the quencher molecules are infinitely dilute, our starting point is that $K^0 = K^0(D,t,k,R)$, where D is the sum of the diffusion coefficients of the fluorophore and quencher, k is a rate constant, t is the unquenched lifetime of the fluorophore, and R is the range of interaction between fluorophore and quencher. We then find by dimensional analysis that $K^0$ can be simplified to $K^0 = DRtxF\ (k/DR, Dt/R^2)$, where F(x,y) is a function of just two variables. Furthermore, if S is a function specifying the region of configuration space in which fluorophores and quenchers interact [G. Wilemski and M. Fixman, J. Chem. Phys. 58, 4009 (1973)], we find that $K^0$ depends only upon an average of S over the steady state fluorophore—quencher pair correlation function. Under ordinary conditions, $k/DR$ and $Dt/R^2$ will be large. We note that in this limit $K^0$ approaches the Smoluchowski value 4rDRt. Correction terms to the Smoluchowski value are explicitly computed, however, when S is a delta function or a step function. Inasmuch as both forms lead to corrections tending in the same direction, it may be difficult to distinguish them by experiment. Thus, we conclude that future theoretical work should focus on a more realistic form for S.

**22813 Departures from the Stern—Volmer law for fluorescence quenching in liquids.** Baird, J.K.; Escott, S.P. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Chemical Physics, The ;* **74**: No. 12, 6993-6995(15 Jun 1981).

Fluorescence quenching with solutions of fluorophores and quenchers in inert solvents in considered.(AIP)

**22814 Experimental and theoretical studies of the effects of nonuniformities in equilibrium magnetohydrodynamic flows.** Rosenbaum, M.; Shamma, S.E.; Louis, J.F. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). DE-AC01-79ET15518. *Physics of Fluids ;* **24**: No. 6, 1032-1039(Jun 1981).

An experimental study of the effects of thermal and velocity nonuniformities is performed in an equilibrium plasma for a range of Hall coefficients. By introducing equally spaced cold blades in the radial flow of an electrodeless magnetohydrodynamic disk deivce, it is possible to create well-defined two-dimensional wake nonuniformities with strong variations of the plasma properties in the direction normal to the magnetic field and the flow. This type of nonuniformity and orientation theoretically provides the strongest reduction of Hall coefficient and effective conductivity for high values of the Hall coefficient. This degradation which reached more than 50% in some cases, is controlled by both the level of nonuniformities and the value of the ideal Hall coefficient. The former is dependent upon the number of blades (root mean square deviation of the conductivity), and the latter is dependent upon the values of the magnetic field intensities. The results provide basic quantitative information about the effects of conductivity and velocity nonuniformities on the performance of equilibrium magnetohydrodynamic generators over a wide range of Hall coefficients. The theoretical predictions are derived from a detailed two-dimensional electrodynamic analysis and a simplified engineering model based on a generalization of Rosa's layer model. These experiments validate the analytical studies and support the use of the theoretical layer nonuniform models in describing the effect of boundary layers on the performance of linear magnetohydrodynamic devices.

**22815 Brownian motion in a flowing fluid revisited.** Ramshaw, J.D. (Theoretical Division, University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids ;* **24**: No. 6, 1210-1211(Jun 1981).

It is shown how the phenomenon of osmosis may be treated using the phenomenological theory of Brownian motion in a flowing fluid. The theory is also generalized to include viscous stresses in the particle and mixture momentum equations.

**22816 Frequency-dependent dielectric response in polar liquids.** Pollock, E.L.; Alder, B.J. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). W-7405-ENG-48. *Physical Review Letters ;* **46**: No. 14, 950-953(6 Apr 1981).

Molecular dynamics computations for point dipolar particles of the time-dependent polarization fluctuations allow evaluation of the dielectric properties. From these the collective effects in the longitudinal component (dipolarons) analogous to the plasma oscillations (plasmons) in Coulomb systems can be readily identified. The transverse mode, by contrast, is strongly damped.

## 6451 Particle Interactions And Properties - Experimental

**22817 (BNL—29465) Highlights of high energy pp, anti pp and $e^+e^-$ interactions.** Wang, L.C. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 40p. (CONF-810246—3). NTIS, PC A03/MF A01.

From Z/sup o/ physics workshop; Ithaca, NY, USA (6 Feb 1981).

Topics covered include: the production cross sections of W/ sup +-/ and $Z^0$; the detection of the $Z^0$ and W/sup +-/; some detailed features of the Drell-Yan model; the onia production; and the Higgs boson and technicolor pseudo scalar production. $e^+e^-$ interactions are compared with the pp and p-anti p interactions. (GHT)

**22818 Precise measurement of the $J^0$ magnetic moment.** Cox, P.T.; Dworkin, J.; Overseth, O.E.; Handler, R.; Grobel, R.; Pondrom, L.; Sheaff, M.; Wilkinson, C.; Deck, L.; Devlin, T.; Luk, K.B.; Rameika, R.; Skubic, P.; Heller, K.; Bunce, G. (Department of Physics, University of Michigan, Ann Arbor, Michigan 48109). *Physical Review Letters ;* **46**: No. 14, 877-880(6 Apr 1981).

The magnetic moment of the $J^0$ hyperon has been measured to be m/sub J0/ = 1.253 +- 0.014 nuclear magnetons. A new measurement of m/sub L/ is also reported.

**22819 Exploratory studies on relativistic heavy-ion central collisions.** Lu, J.J.; Beavis, D.; Fung, S.Y.; Gorn, W.; Huie, A.; Kiernan, G.P.; Poe, R.T.; VanDalen, G. (Department of Physics, University of California, Riverside, California 92521). DE-AT03-80-ER-10626. *Physical Review Letters ;* **46**: No. 14, 898-902(6 Apr 1981).

Central nuclear collisions are studied with a 1.8-GeV/N $^{40}$Ar beam incident on a Pb target. Momentum and angular distributions of negative pions infer a pion temperature of 86.6 +- 3.9 MeV, and a pion-nucleon ratio of 0.21—0.24. The pion multiplicity suggests a suppression of high multiplicity events and a non-Poisson distribution. Pion interferometry analyses are performed; the relationship between pion multiplicity and the collision impact parameter is examined.

**22820 Photoproduction of charmed baryons.** Russell, J.J.; Avery, P.; Butler, J.; Gladding, G.; Goodman, M.C.; O'Halloran, T.; Wattenberg, A.; Wiss, J.; Binkley, M.; Cumalat, J.P.; Gaines, I.; Gormley, M.; Loveless, R.L.; Peoples, J.; Atiya, M.S.; Holmes, S.D.; Knapp, B.C.; Lee, W.; Wisniewski, W.J. (University of Illinois, Urbana, Illinois 61801). *Physical Review Letters ;* **46**: No. 13, 799-802(30 Mar 1981).

Photoproduction of the charmed baryon L/sub c/ is reported. Clear signals are observed in the pK/sub S//sup ts0/ and p-barK/sub S//sup ts0/ decay modes. The observed mass is 2284 +- 5 MeV, with a cross section times branching ratio of 3 nb/nucleon.

**22821 Polarization of $S^+$ hyperons produced by 400-GeV protons.** Wilkinson, C.; Handler, R.; Lundberg, B.; Pondrom, L.; Sheaff, M.; Cox, P.T.; Dukes, C.; Dworkin, J.; Overseth, O.E.; Beretvas, A.; Deck, L.; Devlin, T.; Luk, K.B.; Rameika, R.; Whitman, R.; Heller, K. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review Letters ;* **46**: No. 13, 803-806(30 Mar 1981).

The polarization of 26 000 $S^+$ hyperons produced by 400-GeV protons on Be has been measured. The polarizations of $S^+$ and L hyperons have the opposite sign. The magnitude increases with momentum at 5 mrad production angle, and averages 22% over the momentum range 140 to 280 GeV/c.

## 6452 Particle Interactions And Properties - Theoretical

*REFER ALSO TO CITATION(S) 22736*

**22822 (BNL—29468) Phenomenology of quark mixing and the Kobayashi-Maskawa model.** Wang, L.L.C. (Brookhaven National Lab., Upton, NY (USA)). Apr 1981. Contract AC02-76CH00016. 14p. (CONF-810246—4). NTIS, PC A02/MF A01.

From Z/sup o/ physics workshop; Ithaca, NY, USA (6 Feb 1981).

The status of the determination of the quark mixing matrix in the Kobayashi-Maskawa model and its phenomenological implications are discussed. Much of the talk reviews current work on the subject. Some new results on the CP violation effects in exclusive and inclusive decays of bottom, charm and strange particles are also given.

**22823 (DOE/ER/03992—423) Higher-order JWKB expressions for the energy levels and the wavefunction at the origin.** Pasupathy, J.; Singh, V. (Texas Univ., Austin (USA). Center for Particle Theory). Sep 1980. Contract AS05-76ER03992. 16p. NTIS, PC A02/MF A01.

An exact quantization condition is derived for the energy levels of a particle in a radial potential assumed finite at the origin. This is used to derive corrections to the semiclassical JWKB quantization condition. The normalization integral of the wavefunction is further related to the energy derivative of wavefunction at origin and use this expression to derive the corrections to the semiclassical JWKB expressions for the wavefunction at origin. An application to upsilon leptonic decay width is also given.

**22824 (FERMILAB-Conf—80/64THY) Introduction to gauge theories of the strong, weak, and electromagnetic interactions.** Quigg, C. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1980. Contract AC02-76CH03000. 137p. NTIS, PC A07/MF A01.

The plan of these notes is as follows. Chapter 1 is devoted to a brief evocative review of current beliefs and prejudices that form the context for the discussion to follow. The idea of Gauge Invariance is introduced in Chapter 2, and the connection between conservation laws and symmetries of the Lagrangian is recalled. Non-Abelian gauge field theories are constructed in Chapter 3, by analogy with the familiar case of electromagnetism. The Yang-Mills theory based upon isospin symmetry is constructed explicitly, and the generalization is made to other gauge groups. Chapter 4 is concerned with spontaneous symmetry breaking and the phenomena that occur in the presence or absence of local gauge symmetries. The existence of massless scalar fields (Goldstone particles) and their metamorphosis by means of the Higgs mechanism are illustrated by simple examples. The Weinberg-Salam model is presented in Chapter 5, and a brief resume of applications to experiment is given. Quantum Chromodynamics, the gauge theory of colored quarks and gluons, is developed in Chapter 6. Asymptotic freedom is derived schematically, and a few simple applications of perturbative QCD ae exhibited. Details of the conjectured confinement mechanism are omitted. The strategy of grand unified theories of the strong, weak, and electromagnetic interactions is laid out in Chapter 7. Some properties and consequences of the minimal unifying group SU(5) are presented, and the gauge hierarchy problem is introduced in passing. The final chapter contains an essay on the

current outlook: aspirations, unanswered questions, and bold scenarios.

**22825 (SLAC-PUB—2674) Internal spin structure of the proton from high energy polarized e-p scattering.** Hughes, V.W.; Baum, G.; Bergstroem, M.R. (Yale Univ., New Haven, CT (USA). Dept. of Physics; Stanford Linear Accelerator Center, CA (USA); Bern Univ. (Switzerland)). Feb 1981. Contract AC03-76SF00515. 14p. (CONF-800994—13). NTIS, PC A02/MF A01.

From International symposium on H.E. physics with polarized beams and polarized targets; Lausanne, Switzerland (25 Sep 1980).

A review is given of experimental knowledge of the spin dependent structure functions of the proton, which is based on inclusive high energy scattering of longitudinal polarized electrons by longitudinally polarized protons in both the deep inelastic and resonance regions, and includes preliminary results from our most recent SLAC experiment. Implications for scaling, sum rules, models of proton structure, and the hyperfine structure interval in hydrogen are given. Possible future directions of research are indicated.

**22826 Magnetic moment of massive neutrinos and the cosmic helium abundances.** Lynn, B.W. (Department of Physics, Columbia University, New York, New York 10027). *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2151-2156(15 May 1981).

We point out that if neutrinos have mass they will also develop a magnetic dipole moment. We calculate that moment in the simplest extension of the Weinberg-Salam theory. We then propose that spin precession in the magnetic fields of the early universe may be an important production mechanism for right-handed neutrinos from left-handed neutrinos. We consider two models of the primordial magnetic field: one based on the equipartition of energy and the other a "flux-freezing" model: and show that the angle of spin precession can be large. Since we would expect very different cosmic abundances of $^4$He at present if right-handed neutrinos were to come into thermal equilibrium before the onset of $^4$He production, we are thus able to put a constraint on the amount of spin precession of neutrinos in the early universe. This, in turn, allows us to set severe constraints on either the mass of each light neutrino in the SU(2)/sub L/ x U(1) model, on the magnetic moment in an arbitrary model, or on the magnitude of any intergalactic magnetic field which is a remnant of the early universe.

**22827 How super-renormalizable interactions cure their infrared divergences.** Jackiw, R.; Templeton, S. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology,Cambridge, Massachusetts 02139). DE-AC02-76ER03069. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2291-2304(15 May 1981).

Perturbative expansions in models which possess super-renormalizable interactions of massless fields are beset by severe infrared divergences. We show that the complete theory is well defined and has no such divergences; rather the exact amplitudes are nonanalytic functions of the coupling constant and cannot be expanded in its powers. Typically, logarithms of the coupling constant occur, as well as analytic pieces. The analytic portions cannot be found in perturbation theory; they are determined by matrix elements of composite operators. But the nonanalytic behavior is completely fixed in terms of the theory's other parameters. The present investigation should be relevant to a study of physical quantum chromodynamics at its finite-temperature phase transitions.

**22828 High-temperature Yang-Mills theories and three-dimensional quantum chromodynamics.** Appelquist, T.; Pisarski, R.D. (J. W. Gibbs Laboratory of Physics, Yale University, New Haven, Connecticut 06520). EY-76-C-02-3075. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2305-2317(15 May 1981).

We demonstrate that for sufficiently high temperature T the behavior of any four-dimensional gauge theory with small coupling constant a, at distances beyond the electrical Debye screening length j/sub D/ ~ 1/$\sqrt{}$a-barT, is determined precisely by the corresponding three-dimensional theory. This is the magnetic sector of the original theory, and in the non-Abelian case it is a Yang-Mills theory like three-dimensional quantum chromodynamics ($QCD_3$). We study $QCD_3$ in the loop expansion, which is only valid for distances $<<1/aT$, in both covariant and Coulomb gauges. At a finite order in the loop expansion, the presence of logarithmic infrared divergences signals the appearance of new operators in the operator-product expansion. For example, in a covariant gauge, the gauge self-energy develops infrared divergences at two-loop order associated with the operator A-bar $^2$. Infrared divergences in the Wilson loop are also considered and shown to cancel below the order at which gauge-invariant local operators can appear in the operator-product expansion. The infrared structure of $QCD_3$ at distances $>$ or $\approx 1/aT$ cannot be directly probed in the loop expansion, however. We present a simpler model which is calculable in this infrared limit, and which might serve as a prototype for $QCD_3$. The model is massless scalar $QED_3$, which with N charged scalars is soluble in a 1/N expansion as $N\rightarrow\infty$. Using the 1/N expansion, we demonstrate that infrared softening occurs: the long-range behavior of the photon propagator in massless scalar $QED_3$ is less singular than that of free fields. Infrared softening might also occur in $QCD_3$, although it cannot be demonstrated to finite order in the loop expansion. The implications of an assumed infrared softening in $QCD_3$ for the magnetic sector of Yang-Mills theories at high temperatures are also discussed.

**22829 Axial-vector anomaly in lattice gauge theory.** Kerler, W. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). DE-AC03-76SF00515. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2384-2387(15 May 1981).

An exact derivation of the anomalous Ward-Takahashi identities on a finite lattice is given. It is shown in a general way that the contribution from the fermion-degeneracy regularization in the limit leads to the continuum form of the anomaly term. Thus the interconnection is established independently of perturbation theory.

**22830 Parity violation in electron-deuteron scattering I. Methodology and elastic scattering.** Hwang, W.P.; Henley, E.M. (University of Washington, Seattle, Washington 98195). *Annals of Physics (New York) ;* **129**: No. 1, 47-83(1 Oct 1980).

In this paper, we present methodology for investigating theoretically parity violation in both the elastic and break-up channels of electron—deuteron scattering, restricting ourselves to energies in which non-relativistic expansions are allowed for nucleons. The deficiency in the standard impulse approximation related to gauge invariance is remedied by relating it to the "elementary particle" treatment. Results for parity violation in elastic electron—deuteron scattering are presented and discussed.

**22831 Intuitive approach to a generalized parton picture for high-energy lepton—hadron scattering.** Chen, C.K. (Department of Physics, Purdue University, West Lafayette, Indiana 47907). *Annals of Physics (New York) ;* **129**: No. 1, 201-220(1 Oct 1980).

A generalized parton picture is developed, based on the impulse approximation. A parton is allowed to have non-point-like elastic form factors; inelastic current-parton scattering is taken into account explicitly. The amplitude of any exclusive channel of lepton-induced reactions is written down, with the parts containing the long-distance and the short-distance behavior of interaction dynamics clearly separated. Scaling violation is a natural feature of this picture. The inelastic structure functions, $W_1$ and $nW_2$, are studied in this scheme using various different theories; perturbative QCD, the scale-invariant parton model, the hadron bootstrap picture, and a phenomenological stripped-down hadron-parton model. The application of this picture to elastic lepton-hadron scattering and the problem of the selection of an infinite momentum frame are also discussed.

## 6453 Particle Invariance Principles And Symmetries

**22832 How unique are SU(5) and SO(10) grand unified theories?.** Tosa, Y.; Okubo, S. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). DE-AC02-76 ERI3065. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2486-2488(15 May 1981).

We find that SU(5) and SO(10) grand unified theories are almost uniquely chosen under the major ansatz: only left-handed particles in SU(2) doublets and their antiparticles in SU(2) singlets. We have not used any information on the color group, family structures, or quark-lepton correspondence, etc., at all. The consequence of grand unification is that the color group is SU(3), quarks come in color triplet, and their electric charges are 2/3 and -1/3.

**22833 Grand unification in N = 8 extended supergravity.** Frampton, P.H. (Institute of Field Physics, Department of Physics and Astronomy, University of North Carolina, Chapel Hill, North Carolina 27514). *Physical Review Letters ;* **46**: No. 14, 881-883(6 Apr 1981).

The embedding of color SU(3)/sub c/ in the SU(8) of extended supergravity is analyzed under certain simplifying assumptions. It is shown how reality under SU(3)/sub c/ as required by parity conservation forces the massless SU(8) supermultiplets to combine into massive Sp(16) supermultiplets; this, together with naturalness, would necessitate superheaviness for all composites.

## 6454 Field Theory

*REFER ALSO TO CITATION(S) 22827, 22828, 22829, 22833*

**22834 (BNL—29546) Is Yang-Mills equation a totally integrable system. Lecture III.** Chau Wang, L.L. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 16p. NTIS, PC A02/MF A01.

Topics covered include: loop-space formulation of gauge theory - loop-space chiral equation; two dimensional chiral equation - conservation laws, linear system and integrability; and parallel development for the loop-space chiral equation - subtlety.

**22835 (DOE/ER/02271—T2) Theoretical high energy physics. Progress report, May 1, 1980-April 30, 1981.** Lee, T.D. (Columbia Univ., New York (USA). Dept. of Physics). May 1981. Contract AC02-76ER02271. 22p. NTIS, PC A02/MF A01.

The following results have been obtained: (a) A generalization of the Villian-type action to non-Abelian gauge groups has been developed. (This exploits the solution to the diffusion equation on the group manifold.) (b) The equivalence between the Villian U(1) lattice gauge theory and a noncompact Abelian gauge theory with monopoles has been generalized to relate a lattice gauge theory with gauge group G to a second gauge theory with group G bar and non-Abelian monopoles. Here G bar is the covering group of G and common terms in the character expansions of the two theories must agree. (c) A definition of a random lattice in n dimensions has been developed. The resulting lattice has greater rotational symmetry than the usual rectangular lattice and is a promising candidate for both numerical and analytical investigation. So far analytical results have been obtained for (1) various average properties (i.e. coordination number, link length, etc.) of the lattice, (2) the long distance, weak coupling limit of certain Green's functions, and (3) the strong coupling limit of the expectation value of a Wilson loop. The latter, (4), shows properties of a roughened loop suggesting that the random lattice may have a strong coupling limit that is more physical than in the usual rectilinear case.

**22836 Covariant propagators for massive arbitrary-spin fields.** Singh, L.P.S. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). EY-76-C-03-3065. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2236-2242(15 May 1981).

Covariant propagators for massive arbitrary-spin Dirac-Fierz-Pauli and Rarita-Schwinger fields are obtained in a closed form. This is done by using the minimal Lagrangians for these fields along with Schwinger's method of external sources. The resulting expression in the boson case is a straightforward generalization of the results of various authors for spin values up to 5. The propagators are found to depend on the nature of auxiliary fields used in the formalism; the minimal Lagrangian leads to the simplest propagator.

**22837 Fermionic expansion in quantum electrodynamics.** Coquereaux, R. (Gordon McKay Laboratory, Harvard University, Cambridge, Massachusetts 02138). DE-A502-76ER03227. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2276-2284(15 May 1981).

Within the framework of an Abelian U(1) gauge theory, with N massive fermions, we develop the formalism of the 1/N expansion and compute explicitly the b function of the on-shell renormalization scheme up to first nontrivial order. Borel summability is discussed.

**22838 Coupling-constant analyticity and the renormalization group.** Khuri, N.N. (Rockefeller University, New York, New York 10021). DE-AC02-76ER 2232B.000. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2285-2290(15 May 1981).

It is shown that for all definitions of coupling constants any analytic continuation in the coupling parameter of the Green's functions of quantum chromodynamics is limited to a horn-shaped domain with zero opening angle. This extends a result of 't Hooft's obtained for one specific choice of coupling parameter to all possible choices. For some choices of coupling parameter, it is also shown that the renormalization group itself leads to an analytic continuation in the coupling constant for the Green's functions regular in the above domain.

**22839 Systematic framework for generating multimonopole solutions.** Prasad, M.K.; Sinha, A.; Wang, L.C. (Department of Mathematics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2321-2334(15 May 1981).

We describe a systematic framework for the construction of monopole solutions, as static self-dual gauge fields with appropriate boundary conditions, of arbitrary topological charge. This procedure is based on the Atiyah-Ward Ansatz, which is explicitly constructed and has some parameters. The solution, in general, is complex and has singularities, though it is static and has appropriate asymptotic behavior for a monopole solution. The conditions for the solution to be nonsingular and gauge transformable to a real form are given in simple algebraic form. We can then, in principle, check by explicit calculation if they are satisfied for some values of the parameters, or prove the existence of a choice of these parameters. However, we have not yet succeeded in determining these parameters besides the already known cases of one- and two-monopole solutions. We give explicit expressions for the gauge transformations and the real potentials, when these parameters can be chosen to satisfy the smoothness and reality conditions.

**22840 Relationship between lattice and continuum definitions of the gauge-theory coupling.** Dashen, R.; Gross, D.J. (The Institute for Advanced Study, Princeton, New Jersey 08540). EY-76-S-02-2220. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2340-2348(15 May 1981).

We generalize the background-field method to lattice gauge theories. By evaluating the lattice partition function in a weak background lattice field for weak coupling we determine the relationship between the lattice definition of the coupling and that of dimensional regularization. This corresponds to a determination of the ratio of the renormalization scale parameters for these definitions. We find, for an SU(N) lattice gauge theory with the Wilson action, that (L/sub M/S/L/sub L/)/sub( SUN/) = 38.852 704 $\exp(-3\pi^2/11N^2)$.

**22841 Asymptotic mass spectrum and thermodynamics of the Abelian bag model.** Kapusta, J.I. (Theoretical Division, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2444-2453(15 May 1981).

A statistical evaluation of the mass spectrum in the bag model is made using the microcanonical ensemble. The mass spec-

trum behaves asymptotically as $p(m) \sim cm^{-3}\exp(m/T_0)$, where c and $T_0$ depend on the bag constant, on the number of degrees of freedom of massless elementary fields in the bag, and on whether those fields obey Bose-Einstein, Fermi-Dirac, or Maxwell-Boltzmann statistics. Hence this model satisfies the strong bootstrap condition. The case of eight elementary Abelian vector fields is focused on. The thermodynamics of a system of such composite hadrons naively exhibits a maximum temperature $T_0$. However, due to the finite size of hadrons, many-body effects cause the mass spectrum to have a density-dependent cutoff. A first-order phase transition to a gas of free elementary fields is found at a temperature T/ sub c/ = 1.05 $T_0$.

**22842 Construction of exact Yang-Mills-Higgs multimonopoles of arbitrary charge.** Prasad, M.K.; Rossi, P. (Department of Mathematics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). DE-AC02-76ER03069. *Physical Review Letters ;* **46**: No. 13, 806-809(30 Mar 1981).

Exact axially symmetric multimonopole solutions of arbitrary topological charge are presented and their relevant features discussed.

# 65 PHYSICS RESEARCH

## 6510 Nuclear Physics

**22843 (DOE/NDC—22/U) Compilation of requests for nuclear data.** (Brookhaven National Lab., Upton, NY (USA)). Mar 1981. Contract AC02-76CH00016. 90p. (BNL-NCS—51354). NTIS, PC A05/MF A01.

A request list for nuclear data which was produced from a computerized data file by the National Nuclear Data Center is presented. The request list is given by target nucleus (isotope) and then reaction type. The purpose of the compilation is to summarize the current needs of US Nuclear Energy programs and other applied technologies for nuclear data. Requesters are identified by laboratory, last name, and sponsoring US government agency. (WHK)

**22844 (LBL—11588) Nuclear science. Annual report, July 1, 1979-June 30, 1980.** Myers, W.D.; Friedlander, E.M.; Nitschke, J.M.; Stokstad, R.G. (eds.). (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 242p. NTIS, PC A11/MF A01.

This annual report describes the scientific research carried out within the Nuclear Science Division (NSD) during the period between July 1, 1979 and June 30, 1980. The principal objective of the division continues to be the experimental and theoretical investigation of the interactions of heavy ions with target nuclei, complemented with programs in light ion nuclear science, in nuclear data compilations, and in advanced instrumentation development. The division continues to operate the 88 Inch Cyclotron as a major research facility that also supports a strong outside user program. Both the SuperHILAC and Bevalac accelerators, operated as national facilities by LBL's Accelerator and Fusion Research Division, are also important to NSD experimentalists. (WHK)

## 6511 Experimental Techniques

*REFER ALSO TO CITATION(S) 22858*

**22845 Method for determining the neutron multiplicity for gamma rays from (particle,xnγ) reactions.** Fields, C.A.; De Boer, F.W.N.; Ristinen, R.A.; Samuelson, L.E.; Smith, P.A. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). *Nuclear Instruments amp Methods ;* **169**: No. 1, 173-177(Feb 1980).

A technique is presented for identifying γ-rays from specific (particle,xnγ) reactions by measuring the time-of-flight of the outgoing neutrons. γ-rays associated with different neutron multiplicities are shown to be coincident with different parts of the neutron time-of-flight spectrum.

## 6512 Nuclear Properties And Reactions, A=1-5

*REFER ALSO TO CITATION(S) 22506*

**22846 Mechanisms for (p,p') reactions in the continuum.** Wu, J.R. (Oak Ridge National Lab., TN (USA); Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). *Physics Letters, [Section] B ;* **91**: No. 2, 169-172(Apr 1980).

The strong forward angle peaking ovserved in the high energy continuum of inelastic (p,p') spectra is shown to be dominated by a single scattering (or quasi-elastic) mechanism. The multiple scattering processes, i.e. proton emitted after two or more collisions inside the nucleus, also contributes a significant yield to (p,p') spectra and becomes more important at backward angles.

**22847 Resonances in the trineutron-system.** Bistirlich, J.A.; Crowe, K.M.; Miller, J.; Rosenblum, S.S.; Rowe, P.C.; Shively, F.T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Grilly, E.R.; Kerr, E.C.; Novak, J.; Shermann, R.H. (Los Alamos Scientific Lab., NM (USA)). *Helvetica Physica Acta ;* **52**: No. 3, 415(25 Jan 1980).

From Spring session of the Swiss Society of Physics; Basle, Switzerland (5 - 6 Apr 1979).

## 6513 Nuclear Properties And Reactions, A=6-19

*REFER ALSO TO CITATION(S) 21696*

**22848 Evidence for giant E2 transitions in high-energy a-particle capture.** Sandorfi, A.M.; Collins, M.T.; Millener, D.J.; Nathan, A.M.; LeBrun, S.F. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). DE-AC02-76CH00016. *Physical Review Letters ;* **46**: No. 14, 884-887(6 Apr 1981).

High-energy g rays have been observed from the $^{12}C(a,g)$ reaction decaying from states between 32 and 39 MeV in $^{16}O$. A narrow unexpectedly strong line, corresponding to decay to a state at 14.8 +- 0.1 MeV in $^{16}O$, was observed with an angular distribution suggesting a strong E2 component. Structure in the excitation function of this transition favors a resonant rather than direct capture mechanism. Comparisons with SU(3)- and shell-model calculations suggest a giant quadrupole excitation built on the $6_1^+$ state in $^{16}O$.

## 6514 Nuclear Properties And Reactions, A=20-38

**22849 Orbital recoupling dominance in the A = 20 isovector giant M1 transition.** Martoff, C.J.; Bistirlich, J.A.; Crowe, K.M.; Koike, M.; Miller, J.P.; Rosenblum, S.S.; Zajc, W.A.; Baer, H.W.; Wapstra, A.H.; Strassner, G.; Truoel, P. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). W-7405-ENG-48. *Physical Review Letters ;* **46**: No. 14, 891-894(6 Apr 1981).

The photon spectrum from $^{20}Ne(0^-,\gamma)^{20}F$ has been measured. The branching ratio to $^{20}F(1^+,1.06\ MeV)$ is compared to the analogous M1 decay width $^{20}Ne(1^+,11.24\ MeV) \rightarrow {}^{20}Ne(g.s.)$. This determines the relative importance of spin and orbital magnetization in the transition amplitude. The M1 amplitude is found to contain only (47 +- 16)% spin flip, in agreement with shell-model calculations. Excitation of $2^-$ states by $^{20}Ne(\pi^-,\gamma)$ is also observed.

## 6515 Nuclear Properties And Reactions, A=39-58

**22850 Exchange current effects in magnetic electron scattering from $^{49}$Ti, $^{51}$V, $^{59}$Co, $^{87}$Sr, and $^{93}$Nb.** Dubach, J. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Nuclear Physics, [Section] A ;* **340**: No. 2, 271-288(May 1980).

Recent high-multipolarity elastic magnetic electron-scattering experiments on $^{49}$Ti, $^{51}$V, $^{59}$Co, $^{87}$Sr, and $^{93}$Nb yield information about the radial distribution of single proton and neutron orbits in the fsub(7/2) and gsub(9/2) shells. We examine the effects of exchange currents on the analysis of these measurements by present-

ing a series of fits to the data both excluding and including exchange currents. The exchange currents are shown to be a significant effect that may alter previous conclusion from these experiments.

## 6517 Nuclear Properties And Reactions, A=90-149

**22851 Rigid rotation and l-wave fractionation in the deep-inelastic reaction: 664 MeV $^{84}$Kr+/sup nat/Ag.** Sobotka, L.G.; Hsu, C.C.; Wozniak, G.J.; Rattazzi, G.U.; McDonald, R.J.; Pacheco, A.J.; Moretto, L.G. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). W-7405-ENG-48. *Physical Review Letters ;* **46**: No. 14, 887-890(6 Apr 1981).

Out-of-plane angular distributions have been measured for sequential a decay from targetlike fragments produced in fully damped heavy-ion collisions. Fragment spins, extracted from the angular distributions, and g multiplicity data are consistent with rigid rotation of an intermediate complex composed of two substantially deformed spheroids. Over the limited range of asymmetries populated, l fractionation appears to play a minor role.

## 6518 Nuclear Properties And Reactions, A=150-189

**22852 Particle angular momentum alignment effects in deformed nuclei.** Peker, L.K. (Brookhaven National Lab., Upton, NY (USA). National Nuclear Data Center); Rasmussen, J.O. (California Univ., Berkeley (USA). Dept. of Chemistry); Hamilton, J.H. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Physics). *Physics Letters, [Section] B ;* **91**: No. 3/4, 365-368(Apr 1980).

Systematic examinations of the angular momentum generated by particle alignment were made for Dy and Er isotopes. Marked deviations are observed from the aligned spin values expected for full alignment of i/sub(13/2)/ (odd A) and (i/sub(13/2)/)$^2$ (even A) particles. Suggested origins of these differences are presented.

## 6519 Nuclear Properties And Reactions, A=190-219

*REFER ALSO TO CITATION(S) 22819*

**22853 Gamow-Teller strength distribution in the vicinity of A = 90. Pt. 1. Schematic calculation of GT strength in $^{90,92,94}$Nb.** Prussin, S.G.; Oliveira, Z.M. (California Univ., Berkeley (USA). Dept. of Nuclear Engineering). *Nuclear Physics, [Section] A ;* **339**: No. 3, 503-512(May 1980).

The distributions of Gamow-Teller strength in $^{90,92,94}$Nb have been calculated utilizing the so-called GT force in the random phase approximation. For $^{90}$Nb the calculated distribution is in striking agreement with that part of the $^{90}$Zr(p,n) excitation function leading to $1^+$ excitations in $^{90}$Nb and qualitative agreement is demonstrated for data from the reactions $^{92,94}$Zr(p,n). Some 25% of the GT strength is found to lie well below the structureless giant resonance proposed by Ikeda et al. The implications of this result to the $\beta$-decay properties of neutron rich nuclei near A = 90 are discussed.

## 6520 Nuclear Properties And Reactions, A=220 And Above

*REFER ALSO TO CITATION(S) 22843, 22844, 22854, 22854*

## 6530 Nuclear Theory

**22854 (LA-UR—81-1555) Nuclear equation of state studied with high-energy heavy ions.** Nix, J.R.; Strottman, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.); Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 24p. (CONF-810563—1). NTIS, PC A02/MF A01.

From Adriatic europhysics study on nuclear physics dynamics of heavy-ion collisions conference; Croatis, Yugoslavia (25 May 1981).

The current knowledge and theoretical speculations concerning the nuclear equation of state is discussed. Conventional relativistic nuclear fluid dynamics, which is based on the assumption that the nucleon mean free path is zero and consequently neglects the interpenetration of the target and projectile upon contact, is also discussed. Results of such calculations performed for three different equations of state are compared with experimental data for both all impact parameters and central collisions for the reaction $^{20}$Ne + $^{238}$U at a laboratory bombarding energy per nucleon of 393 MeV. These comparisons suggest that we need to take into account target and projectile interpenetration, which is done on the basis of a two-fluid model. An assessment of the present status and future prospects for determining the nuclear equation of state with high-energy heavy ions is given. (WHK)

**22855 Doorway state approach to optical potential scattering.** Lenz, F.; Moniz, E.J.; Yazaki, K. (Schweizerisches Institut fuer Nuklearforschung, Villigen, Switzerland; and Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). EY-76-6-02-3069. *Annals of Physics (New York) ;* **129**: No. 1, 84-109(1 Oct 1980).

We extend and apply the doorway state approach in the context of optical potential scattering. This entails construction of doorway basis states for resolving the transition operator. We focus on analytic solutions to comparatively simple problems in optical potential scattering. Both low and high energy limits are considered, and absorptive interactions are treated; both on- and off-shell partial wave amplitudes are constructed. Further, the full scattering amplitude in the high energy limit is calculated directly in the doorway expansion. With our analytic results it is possible to identify the physical parameters controlling convergence of the doorway expansion. The same parameters apply over the entire range of cases studied. These parameters are related simply to the target geometry and to the interaction strength. For interactions appropriate to hadron—nucleus scattering, convergence of both on- and off-shell amplitudes is very rapid.

**22856 Interpretation of some low equation results.** Miller, G.A.; Henley, E.M. (Institute for Nuclear Theory, Department of Physics, University of Washington, Seattle, Washington 98195). *Annals of Physics (New York) ;* **129**: No. 1, 131-152(1 Oct 1980).

Diagrammatic arguments are used to obtain the propagator modifications contained in previous solutions of pion-nucleus Low equations.

## 6540 Radiation And Shielding Physics

**22857 Anomalous scattering of X-rays by cesium and cobalt measured with synchrotron radiation.** Templeton, D.H.; Templeton, L.K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Phillips, J.C.; Hodgson, K.O. (Stanford Univ., CA (USA). Dept. of Chemistry). *Acta Crystallographica, Section A: Crystal Physics, Diffraction, Theoretical and General Crystallography ;* **36**: No. 3, 436-442(1 May 1980).

Both real and imaginary components of the anomalous X-ray scattering were measured by single-crystal diffraction experiments with synchrotron radiation at wavelengths through the region of the three L absorption edges of cesium, the first such experiment for any element at the L edges. Similar experiments were performed with cobalt near the K edge.

**22858 (BNL-NCS—29035) New aspects in the evaluation of thermal neutron cross sections.** Mughabghab, S.F. (Brookhaven National Lab., Upton, NY (USA)). 1980. Contract AC02-76CH00016. 32p. (CONF-800979—16). NTIS, PC A03/MF A01.

From Workshop on nuclear data evaluation methods and procedures; Upton, NY, USA (22 Sep 1980).

Because of recent advances in experimental techniques, which improved the accuracies of thermal capture and scattering cross sections by an order of magnitude, a more stringent approach in the evaluation of the thermal constants is developed. In the pres-

ent approach, the following aspects are introduced: (1) a consistency between thermal cross sections, coherent and incoherent scattering lengths, and neutron resonance parameters is achieved; (2) a consistency between the isotopic and element cross sections is sought; in addition, for each isotope, the requirement that the partial cross sections add up to the total is fulfilled; (3) where possible, charged particle data particularly derived from (d,p) reactions on light and medium weight isotopes are used in locating the positions and strengths of bound levels. Such a procedure is useful in the evaluation of the shape of the cross sections in the thermal region; and (4) the Lane-Lynn theory of direct capture is called upon to calculate thermal cross sections and check for consistencies for certain isotopes. Extensive examples to illustrate these procedures are presented.

**22859 (UCID—19055) Mathematical models for the EPIC code.** Buchanan, H.L. (Lawrence Livermore National Lab., CA (USA)). 3 Jun 1981. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01.

EPIC is a fluid/envelope type computer code designed to study the energetics and dynamics of a high energy, high current electron beam passing through a gas. The code is essentially two dimensional (x, r, t) and assumes an axisymmetric beam whose r.m.s. radius is governed by an envelope model. Electromagnetic fields, background gas chemistry, and gas hydrodynamics (density channel evolution) are all calculated self-consistently as functions of r, x, and t. The code is a collection of five major subroutines, each of which is described in some detail in this report.

## 6550 Medical Physics

*REFER ALSO TO CITATION(S) 22491*

**22860 (LA—8799-MS) Nuclear accident dosimetry: Los Alamos measurements at the seventeenth nuclear accident dosimetry intercomparison study at the Oak Ridge National Lab., DOSAR Facility, August 1980.** Vasilik, D.G.; Martin, R.W. (Los Alamos National Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 20p. NTIS, PC A02/MF A01.

Teams from various US and foreign organizations participated in the Seventeenth Nuclear Accident Dosimetry Study held at the Oak Ridge National Laboratory's (ORNL) Dosimetry Applications Research (DOSAR) facility August 11 to 15, 1980. Criticality dosimeters were simultaneously exposed to pulses of mixed neutron and gamma radiation from the Health Physics Research Reactor (HPRR). This report summarizes the experimental work conducted by the Los Alamos team. In-air and phantom measurements were conducted by the Los Alamos team using area and personnel dosimeters. Combined blood sodium and sulfur fluence measurements of absorbed dose were also made. In addition, indium foils placed on phantoms were evaluated for the purpose of screening personnel for radiation exposure. All measurements were conducted for unshielded, 5-cm steel and 20-cm concrete shielding configurations. All participant dosimeters were exposed at 3 m from the center of the HPRR core.

**22861 (PNL-SA—9333) Historical perspectives on limits for internal emitters.** Bair, W.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 41p. (CONF-810365—1). NTIS, PC A03/MF A01.

From Joint meeting of the Columbia and Northern California chapters of the Health Physics Society on internal dosimetry; Lake Tahoe, CA, USA (22 Mar 1981).

An historical perspective on the development of exposure limits for internal emitters is given. The emphasis of the presentation is on concepts rather than on a chronological sequence of events. (ACR)

## 6560 Solid State Physics

*REFER ALSO TO CITATION(S) 22279*

**22862 Melting of a two-dimensional electron lattice.** Kalia, R.K.; Vashishta, P.; de Leeuw, S.W. (Solid State Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter ;* **23**: No. 9, 4794-4797(1 May 1981).

Melting of a 2D (two-dimensional) electron lattice is studied using molecular-dynamics technique. It is found that the system undergoes a first-order phase transition between G[ = e²(rn)/sup 1/2//k/sub B/T] = 118—130. The system exhibits hysteresis in the temperature dependence of total energy and the coefficient of self-diffusion. The latent heat of melting is found to be 0.09 K per particle.

**22863 (UCRL-Trans—11663) Nonlinear refractive index $N_2$ of transparent dielectric crystals.** Fu-Xi, G.; Feng-Ying, L. Translated from *Wu-li (Physics) ;* **8**: No. 5, 385(1979). 15p. NTIS, PC A02/MF A01.

All crystals in which symmetry centers are not present have second-type (third rank) polarization tensors, and produce electrooptic phenomena, second harmonics, parametric amplification, and other effects, whereas all types of symmetric crystals have third-type (fourth rank) polarizaton tensors which cause self-focusing, self-phase modulation, self-induced polarizing transformation, third harmonics, four-wave mixing, the Kerr effect, and stimulated scattering effects. The second-order nonlinear effects of crystals have been studied quite extensively in the past. Because the power of lasers is increasing continually, third-order nonlinear effects become more important every day. The third-type polarization coefficient chi/sub ijlk/ and the nonlinear refractive index $n_2$ of transparent dielectric cyrstals therefore is studied.

**22864 (ORNL-tr—4750) Electromagnetic waves in a half-space plasma.** Romanov, Yu.A. Translated from *Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika ;* **7**: 242(1964). 14p. NTIS, PC A02/MF A01.

By the kinetic equation method plasma energy spectrum of half space plasma has been considered assuming a mirror reflection of electrons from the boundary. The problem is considered of the excitation of the surface plasma waves by slow electrons.

## 6561 Superconductivity

*REFER ALSO TO CITATION(S) 22317*

**22865 Time-dependent voltage generated by flux motion across a superconducting strip.** Clem, J.R. (Ames Laboratory—USDOE and Department of Physics, Iowa State University, Ames, Iowa). *Journal of Low Temperature Physics ;* **42**: No. 3, 363-371(1 Feb 1981).

A brief review is given of the theory predicting that the instantaneous voltage generated by single-quantum vortices or multiquanta flux tubes moving through a superconducting specimen depends upon both the specimen shape and the spatial configuration of the measuring circuit. This theory is then applied to obtain the voltage pulses expected from two different measuring circuits attached to a superconducting strip. The time-dependent voltage is predicted to be proportional not only to the vortex or flux-tube velocity but also to a geometry-dependent function of the position of the vortex or flux tube relative to the measuring circuit.

## 6570 Theoretical Physics

*REFER ALSO TO CITATION(S) 22833*

**22866 (UCID—19024) Translation operator for finite dmensional electromagnetic fields.** Howard, A.Q. Jr. (Lawrence Livermore National Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 45p. NTIS, PC A03/MF A01.

Computation of electromagnetic fields in particular applications is usually accompanied by the adhoc assumption that the field contains a finite number of degrees of freedom. Herein, this assumption is made at the outset. It is shown that if an annular region

between two closed surfaces contains no sources or sinks and is isotropic, lossless and homogeneous, a unique translation operator can be defined algebraically. Conservation of energy defines the translation operator T to within an arbitrary unitary transformation. The conditions of causality, unitarity and energy conservation are shown to uniquely determine T. Both scalar and vector fields are treated. In both of these cases, frequency and time domain transforms are computed. The transform T is compared with the analagous one as derived from the time domain Stratton-Chu Formulation. The application to a radiation condition boundary constraint on finite difference and finite element computations is discussed.

22867 **Computer simulations of a continuum system of molecules with a hard-core interaction in the grand canonical ensemble.** Lee, Y.S.; Chae, D.G.; Ree, T.; Ree, F.H. (Korea Advanced Institute of Science, Seoul, Korea). *Journal of Chemical Physics, The ;* **74**: No. 12, 6881-6887(15 Jun 1981).

A method to simulate a semi-infinite continuum system in the grand canonical ensemble is proposed. It uses a Monte Carlo method to evaluate the largest eignvalue of the Kramers—Wannier matrix. For a two-dimensional system of parallel hard squares the pressure and the density computed from the proposed grand-canonical-ensemble method show satisfactory agreement with the corresponding canonical-ensemble calculations at densities below 72% of the close-packed density. An approximate method for high-density calculations is proposed.

22868 **Evolution, symmetry, and canonical structure in dynamics.** Mukunda, N.; Balachandran, A.P.; Nilsson, J.S.; Sudarshan, E.C.G.; Zaccaria, F. (Institute of Theoretical Physics, S-412 96 Goeteborg, Sweden). *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2189-2200(15 May 1981).

The behavior of symmetries of classical equations of motion under quantization is studied from a new point of view. GL(3,R), which is an invariance group of the linear equations of motion for the nonrelativistic free particle as well as the isotropic harmonic oscillator, is imposed as a group of automorphisms on acceptable Poisson brackets, and the consequences are examined in detail. The six independent variables of the classical system arrange themselves, in each acceptable bracket, into one canonical pair and four neutral elements. Consequences of this for the equations of motion, existence of a Hamiltonian, breakup of the states of motion into superselected sectors due to existence of neutral elements, and determination of the canonically realized subgroup of GL(3,R) are all discussed. The possible relevance of this manner of symmetry breakdown for solid state and particle physics is pointed out.

22869 **Form of relativistic dynamics with world lines.** Mukunda, N.; Sudarshan, E.C.G. (Center for Particle Theory and Department of Physics, University of Texas, Austin, Texas 78712). *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2210-2217(15 May 1981).

In any Hamiltonian relativistic theory there are ten generators of the Poincare group which are realized canonically. The dynamical evolution is described by a Hamiltonian which is one of the ten generators in Dirac's generator formalism. The requirement that the canonical transformations reproduce the geometrical transformation of world points generates the world-line conditions. The Dirac identification of the Hamiltonian and the world-line conditions together lead to the no-interaction theorem. Interacting relativistic theories with world-line conditions should go beyond the Dirac theory and have eleven generators. In this paper we present a constraint dynamics formalism which describes an eleven-generator theory of N interacting particles using 8(N+1) variables with suitable constraints. The (N+1)th pair of four-vectors is associated with the uniform motion of a center which coincides with the center of energy for free particles. In such theories dynamics and kinematics cannot be separated out in a simple fashion.

22870 **Constraint dynamics of particle world lines.** Sudarshan, E.C.G.; Mukunda, N.; Goldberg, J.N. (Center for Particle Theory and Department of Physics, The University of Texas, Austin, Texas 78712). DOE-AS05-76ER03992. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2218-2230(15 May 1981).

The Dirac generator fomulations for relativistic Hamiltonian dynamics is extended by explicitly separating the question of dynamical evolution in an inertial frame from that of changes of frame. We obtain a new eleven-generator formalism: ten to realize the Poincare Lie algebra, and one to provide equations of motion. For point-particle systems, a new form of the world-line conditions is developed. It is demonstrated that with these extensions one can consistently describe classical point particles with interaction in a relativistically invariant way while maintaining invariant world lines. This paper uses the approach based on independent particle variables to set up such theories.

22871 **WKB approximation for general matrix Hamiltonians.** Bjorken, J.D.; Orbach, H.S. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). DE-AC03-76SF00515. *Physical Review, The, D. Particles and Fields ;* **23**: No. 10, 2243-2251(15 May 1981).

We present a method of obtaining WKB-type solutions for generalized Schroedinger equations for which the Hamiltonian is an arbitrary matrix function of any number of pairs of canonical operators. Our solution reduces the problem to that of finding the matrix which diagonalizes the classical Hamiltonian and determining the scalar WKB wave functions for the diagonalized Hamiltonian's entries (presented explicitly in terms of classical quantities). If the classical Hamiltonian has degenerate eigenvalues, the solution contains a vector in the classically degenerate subspace. This vector satisfies a classical equation and is given explicitly in terms of the classical Hamiltonian as a Dyson series. As an example, we obtain, from the Dirac equation for an electron with anomalous magnetic moment, the relativistic spin-precession equation.

22872 **Tomographical imaging with limited-angle input.** Tam, K.C.; Perez-Mendez, V. (Lawrence Berkeley Laboratory, Berkeley, California 94720 and Department of Radiology, University of California, San Francisco, California 94143). W-74D5-ENG-48. *Journal of the Optical Society of America ;* **71**: No. 5, 582-592(May 1981).

The theory of tomographical imaging with limited angular input, from which two reconstruction algorithms are derived, is discussed. The existence of missing information because of incomplete angular coverage is demonstrated, and an interation algorithm to recover this information from a priori knowledge of the finite extent of the object is developed. Smoothing algorithms to stabilize reconstructions in the prescence of noise are given. The effects of digitization and finite truncation of the reconstruction region in numerical computation are also analyzed. It is shown that the limited-angle problem is governed by a set of eignvalues whose spectrum is determined by the imaging angle and the finite extent of the object. The distortion on a point source caused by the missing information is calculated; from the results some properties of the iteration scheme, such as spatial uniformity, are derived.

22873 **WKB quantization of pseudo spin Hamiltonians.** Klein, A.; Li, C.T. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104). EY-76-C-02-3071. *Physical Review Letters ;* **46**: No. 14, 895-898(6 Apr 1981).

A new method is proposed for studying the semiclassical limit for model Hamiltonians which are polynomials in the generators of the Lie algebra SU(n). The symmetric representation, characterized by a single independent Casimir invariant is mapped onto a subspace of a set of canonical coordinates, and a systematic expansion in the reciprocal of the Casimir invariant is carried out. WKB calculations for a specific example yield improved accuracy compared to previous work.

22874 **Novel analytic solutions to general four-wave-mixing problems in a Raman medium.** Ackerhalt, J.R. (Theoretical Division, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters ;* **46**: No. 14, 922-925(6 Apr 1981).

A new approach to the problem of steady-state plane-wave propagation in a Raman-active medium has lead to general analytic solutions. Any arbitrary number of fields can interact via both Raman and four-wave processes, but all fields must satisfy the phase matching condition. The solutions are illustrated with a prob-

lem of current interest: multiple first Stokes generation from a multiple-mode pump field.

**22875 Critical point correlations of the Yvon-Born-Green equation.** Jones, G.L.; Kozak, J.J.; Lee, E.; Fishman, S.; Fisher, M.E. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). *Physical Review Letters* ; **46**: No. 13, 795-798(30 Mar 1981).

The critical behavior of the Yvon-Born-Green integral equation for fluids is analyzed by a moment expansion which yields a nonlinear differential equation accurately describing the long-range correlations. Phase plane analyses show that for dimensions d< or =4 a critical point is characterized by h = 4-d with g(r)-1 negative for large distances, r, in contrast to normal expectations. For d>4 the differential equation allows g(r)-1>0 and h = 0 or 4-d. The compressibility never diverges if d = 1.

### 6580 Mathematical Physics

*REFER ALSO TO CITATION(S) 22531*

**22876 Group theory and its applications in physics, 1980.** Seligman, T.H. (ed.). Schenectady, NY; American Institute of Physics (1980). 361p. (CONF-8006126—).

From 9. international colloquium on group theoretical methods in physics; Mexico City, Mexico (Jun 1980).

Lectures were presented in representation theory, elementary particle physics, nuclear physics, and modern applications in mathematical physics. Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

## 70 FUSION ENERGY

### 7001 Plasma Research

**22877 (DOE/ER/53106—T1) Computer simulation of lower-hybrid heating in tokamaks. Final report.** Ogden, J.M. (Ogden (Joan M.), Princeton, NJ (USA)). 29 Apr 1981. Contract AC01-80ER53106. 43p. NTIS, PC A03/MF A01.

A simple quasilinear model was added of lower hybrid heating to the BALDUR 1-D tokamak transport code. The program was used to simulate PLT and the INTOR reactor design. For PLT a temperature increase of ≃ 2 keV/kW of RF input power was predicted. Quasilinear theory gave slightly less heating than linear theory, because of greater electron edge losses.

**22878 (DOE/ET/52040—T2) CTR plasma engineering studies. Annual progress report, 1 October 1980-30 September 1981.** Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1981. Contract AS02-76ET52040. 78p. (COO—2218-216). NTIS, PC A05/MF A01.

During FY 81 much of the effort has been directed at the development of new models and codes involving the following three areas: (1) a 1 1/2-D code for startup and burn studies of high-$\beta$ systems such as the spheromak and reversed field pinch (RFP); (2) a 1-D code for analysis of field reversed theta pinch (FR theta P) systems including scale up of present experiments and pilot reactor concepts; and (3) a dynamic burn code for analysis of pulsed systems such as the moving plasmoid reactor (MPR), including provisions for detailed treatment of high-energy particle slowing. Also refinement and extension of the continued work were performed on electric field control of impurity transport, 1-D radial hybrid start-up code for field-reversed mirror systems, nuclear elastic scattering and anomalous slowing effects on fusion product transport along with RFP start-up. Major findings and computer packages developed and tested with the corresponding systems are of vital information that can be used and compared for plasma behavior in the near-term systems.

**22879 (LA-UR—81-1028) High-speed photodetector for plasma diagnostics.** Lyons, P.B.; Looney, L.D.; Ogle, J.; Simmons, R.D.; Selk, R.; Hopkins, B.; Hocker, L.; Nelson, M.; Zagarino, P. (Los Alamos National Lab., NM (USA); EG and G, Inc., Las Vegas, NV (USA)). 1981. Contract W-7405-ENG-36. 9p. (CONF-810429—17). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

Recent progress in four different classes of high-speed photodetectors are reviewed with emphasis on parameters of importance in plasma diagnostics. Two types of biplanar vacuum photodiodes are compared, the ITT F4014 and the Hamamatsu 1328. A conventional photomultiplier, the nine-stage Hamamatsu R928, has been modified to improve its bandwidth. Microchannel plate photomultipliers from two vendors have been studied. Data for the ITT F4126X, ITT F4141, Varian VPM-173, VPM-221, and VPM-225 are summarized. A hybrid photomultiplier using a PIN diode for a gain element has also been investigated. The various tubes and types provide very different limitations on system performance.

**22880 (LA-UR—81-1148) Eight-chord $CO_2$ interferometer for plasma-density measurements on ZT-40.** Jacobson, A.R.; Jolin, L.J. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810429—20). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

We describe a $CO_2$ laser interferometer which measures the path-integrated density along eight different chords simultaneously in the ZT-40 reversed-field pinch, a toroidal magnetic confinement experiment at Los Alamos. The interferometer system combines several reliable, commercially available components in a package which provides exceptional measurement resolution as well as ease of operation and maintenance.

**22881 (LA-UR—81-1435) Optical diagnostics of $CO_2$ laser-fusion targets using backscattered light.** Casperson, D.E. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 15p. (CONF-810429—26). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

With the f/2.4 focusing optics on one of the eight Helios $CO_2$ laser beam lines, direct backscattered light from a variety of glass microballoon targets has been observed. The quantities that have been measured include: (1) the total backscattered energy; (2) relative amplitudes of the backscattered fundamental and low harmonics (n = 1, 2, 3) of the 10.6 $\mu$m incident light; (3) the 3/2 harmonic emission from a double pulse backscatter experiment; (4) the temporally resolved 10.6 $\mu$m light using a fast pyroelectric detector and a Los Alamos 5-GHz oscilloscope; and (5) the time-integrated spectrally resolved fundamental using a 3/4 meter spectrometer and a high resolution pyroelectric detector array (resolution ~ 40 A at 10.6 $\mu$m). The suitability of these diagnostics for evaluating the $CO_2$ laser plasma in terms of stimulated scattering processes, plasma density gradients, velocity of the critical surface, etc., is discussed.

**22882 (PPPL—1774) Currents generated by lower hybrid waves.** McWilliams, R.; Motley, R.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Apr 1981. Contract AM02-76CH03073. 69p. NTIS, PC A04/MF A01.

Electron currents can be driven in a linear plasma by the absorption of lower hybrid waves excited primarily in one direction. Current-drive has been demonstrated both for collisional and resonant-electron absorption. The magnitude of the excited currents is compared with the predictions from an electron kinetic equation with a Lorentz collision operator in the regime k/sub parallel to/v/sub te//$\omega$<<1.

**22883 (PPPL—1781) Verification of the classical theory of helical transport in stellarators.** Mynick, H.E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Apr 1981. Contract AM02-76CH03073. 23p. NTIS, PC A02/MF A01.

The apparent discrepancies of the classical theory of helical transport in stellarators, versus two recent numerical studies of stel-

larator transport, are investigated. Numerical results are presented, verifying the classical theory, when the model for the magnetic field has the simple form assumed by the classical theory. When the helical contribution to the total transport is isolated numerically, and the different energy dependence of the particle distribution is accounted for, the results of one of the numerical studies is brought into substantial agreement with theory. It is argued that the anomalously favorable low collisionality results of the second numerical study are due partly to numerical procedure, and partly to a more complicated spatial dependence of the magnetic field. The latter may enable collisionless helical detrapping to dominate the usual collisional mechanism at low collisionality, thereby controlling transport.

22884 **(PPPL—1783) Hamiltonian field description of two-dimensional vortex fluids and guiding center plasmas.** Morrison, P.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Mar 1981. Contract AM02-76CH03073. 22p. NTIS, PC A02/MF A01.

The equations that describe the motion of two-dimensional vortex fluids and guiding center plasmas are shown to possess underlying field Hamiltonian structure. A Poisson bracket which is given in terms of the vorticity, the physical although noncanonical dynamical variable, casts these equations into Heisenberg form. The Hamiltonian density is the kinetic energy density of the fluid. The well-known conserved quantities are seen to be in involution with respect to this Poisson bracket. Expanding the vorticity in terms of a Fourier-Dirac series transforms the field description given here into the usual canonical equations for discrete vortex motion. A Clebsch potential representation of the vorticity transforms the noncanonical field description into a canonical description.

22885 **(PPPL—1791) Fusion energy calorimeter for the tokamak fusion test reactor.** Jassby, D.L.; Imel, G.R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Apr 1981. Contract AM02-76CH03073. 9p. NTIS, PC A02/MF A01.

One and two-dimensional neutronic analyses treating the transport and scattering of neutrons and the production and transport of gamma rays in the TFTR demonstrate that the fusion energy production in a D-T pulse in the TFTR can be determined with an uncertainty of +- 15% or less, simply by integrating the measured profile of temperature increase along the central radial axis of a large hydrocarbon moderator that fills the bay between adjacent toroidal-field coils, just outside the vacuum vessel. Limitations in thermopile temperature measurements dictate a minimum fusion-neutron fluence at the vacuum vessel of the order of $10^{12}$ n/cm$^2$ per pulse (a source strength of $10^{18}$ n/pulse in TFTR), in order that this simple calorimeter can provide useful accuracy.

22886 **(PPPL—1792) Toroidal plasma rotation in the PLT tokamak with neutral-beam injection.** Suckewer, S.; Eubank, H.P.; Goldston, R.J.; McEnerney, J.; Sauthoff, N.R.; Towner, H.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Apr 1981. Contract AM02-76CH03073. 34p. NTIS, PC A03/MF A01.

Toroidal plasma rotation in the Princeton Large Torus, PLT, has been measured for various plasma and neutral beam injection conditions. Measurements of the plasma rotational velocities were made from Doppler shifts of appropriate spectral lines and include data from both hydrogen and deuterium beams and co- and counter-injection at several electron densities. Without injection, a small but consistent toroidal rotation exists in a direction opposite to the plasma current (counter-direction) in the plasma center but parallel to the current (co-direction) in the plasma periphery. Using these measured velocities and the plasma density and temperature gradients, radial electron fields can be determined from theory, giving E/sub r / ≥ 40 V/cm near the plasma center and E/sub r/ ≥ 10 V/cm near the plasma edge. Insertion of a local, 2.5 percent magnetic well produced no observable effect on the beam driven rotation. Modeling of the time evolution and radial distribution of the rotation allows one to deduce an effective viscosity of the order of (1 to 5) x $10^4$ cm$^2$/sec.

22887 **(UCAR—10060-80-3) Mirror fusion. Quarterly report, July-September 1980.** Harrison, M.A.; McGregor, C.K. (eds.). (Lawrence Livermore National Lab., CA (USA)). 8 Dec 1980. Contract W-7405-ENG-48. 113p. NTIS, PC A06/MF A01.

Our intent in the Mirror Fusion Quarterly Report is to provide a timely summary of activities within the Magnetic Fusion Energy (MFE) Program at Lawrence Livermore National Laboratory. In a given Quarterly, not all MFE projects are necessarily represented. Throughout, details are kept to a minimum; readers desiring additional information are encouraged to read referenced documents or to contact the individuals engaged in the projects. The information in each Quarterly is presented in the same sequence as in the Field Work Package Proposal and Authorization System (WPAS) submissions prepared for the US Department of Energy; the main sections are applied Plasma Physics, Confinement Systems, Development and Technology, and Mirror Fusion Test Facility (Planning and Projects).

22888 **(UCRL—53099) VEPEC: a 3D vector potential equilibrium code for high-beta minimum-B plasma confinement.** Anderson, D.V.; Breazeal, J.; Sharp, C.B. (Lawrence Livermore National Lab., CA (USA)). 15 Jan 1981. Contract W-7405-ENG-48. 51p. NTIS, PC E03/MF $3.50.

Includes 4 sheets of 48x reduction microfiche.

Several applications of plasma equilibrium models require a suitable continuous representation for the magnetic field. For example, numerical generation of single particle orbits in these fields requires that the continuum representation maintain del B = 0 or at least keep it very small. Performing the interpolation analysis in terms of the vector potential, A, guarantees del B = 0 whereas using the magnetic induction, B, does not. The code presented here uses A as the primary dependent variable. A finite element representation employing tricubic splines significantly reduces spatial truncation errors compared to conventional finite difference methods. Some results pertinent to the MFTF-B experiment are presented. Many details about the code are presented on fiche as described in the appendices.

22889 **Spontaneous ion-acoustic generation in a high power, multifilament ion source.** Schoenberg, K.F.; Kunkel, W.B. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physics of Fluids ;* **24**: No. 6, 1040-1044(Jun 1981).

Under certain operating conditions, a high power, multifilament ion source can effectively function as a spontaneously excited ion-acoustic resonator. The fluctuations, initially excited by a current-driven instability at the thermionic source cathode, exhibit a Lorentzian spectral profile where the resonant frequency is solely determined by the spatial cathode configuration, and the resonance half-width is set by the mean plasma ion lifetime. The ion wave-cathode interaction, responsible for the resonant behavior, entails a feedback mechanism dependent on the electrostatic wave scattering properties of thermionic filaments operated under space-charge-limited conditions. Fluctuation amplitude levels are insufficient to significantly perturb the ions and consequently, the instability does not affect the performance of a multifilament source neutral beam system.

22890 **Numerical simulations of electrostatic hydrogen cyclotron instabilities.** Okuda, H.; Cheng, C.Z.; Lee, W.W. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). DE-AC02-76-CH03073. *Physics of Fluids ;* **24**: No. 6, 1060-1068(Jun 1981).

Both one- and two-dimensional particle simulation models have been used to study the nonlinear behavior of the electrostatic hydrogen cyclotron instabilities driven by the electron current along the magnetic field. It is found that the instability saturates as a result of electron velocity space diffusion along the magnetic field. The cyclotron waves remain highly coherent in the nonlinear stage. When the electron drift speed is comparable to the thermal speed, substantial ion heating as well as particle cross-field diffusion comparable to Bohm diffusion has been observed. Comparisons of the simulation results with the theoretical predictions and the observations in both laboratory and space plasmas are discussed.

**22891 Current-driven microinstabilities in a neutral sheet.** Winske, D. (Department of Physics, and Astronomy, University of Maryland, College Park, Maryland 20742). *Physics of Fluids ;* **24**: No. 6, 1069-1076(Jun 1981).

Computer simulation is used to investigate current-driven microinstabilities in a simple reversed field (neutral sheet) configuration. A long wavelength, predominantly electromagnetic, instability develops at the reversal point as a consequence of the lower hybrid drift instability, which is excited away from the reversal point where the density gradients are steep. The resulting anomalous resistivity is much smaller at the null point.

**22892 Toroidal drift modes driven by ion pressure gradients.** Horton, W. Jr.; Duk-In, C.; Tang, W.M. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712). DE-AC05-76ET53036. *Physics of Fluids ;* **24**: No. 6, 1077-1085(Jun 1981).

Ion pressure gradient-driven drift modes are analyzed for their parametric dependence on the shear, the toroidal aspect ratio, and the pressure gradient using the ballooning toroidal mode theory. An approximate formula for the anomalous ion thermal conductivity is derived for the turbulent regime.

**22893 Electron-cyclotron resonance heating in plasmas with arbitrary stratification of the magnetic field.** Friedland, L.; Porkolab, M. (Yale University, New Haven, Connecticut 06520). *Physics of Fluids ;* **24**: No. 6, 1097-1098(Jun 1981).

Cyclotron resonance absorption in a plasma with arbitrary stratification of the magnetic field is considered. Using the absorption coefficient derived for perpendicular stratification, simple analytic estimates of the absorption can be made for artrary stratification.

**22894 Toroidal effects on propagation, damping, and linear mode conversion of lower hybrid waves.** Ignat, D.W. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). DE-AC02-76-CJ03073. *Physics of Fluids ;* **24**: No. 6, 1110-1114(Jun 1981).

A common simplifying assumption made in the consideration of radio-frequency heating of tokamaks near the lower hybrid frequency is that the wavelength imposed by the coupling device parallel to the magnetic field is not modified by gradients along the field. In the present calculation, the parallel wavelength is allowed to vary, and important effects are found on wave penetration and damping if the toroidal aspect ratio (R/sub major//r/sub minor/) is less than approximately five. The calculation shows that heating at the center of a small aspect ratio torus is inhibited by a decrease in k/sub parallel/ if waves are launched at the outside, and that it may be possible to change the plasma current via electron Landau damping with a coupler of symmetric power spectrum by placing the coupler at the top (or bottom) of the torus.

**22895 Irreversibility and transport in the lower hybrid drift instability.** Drake, J.F.; Lee, T.T. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20740). *Physics of Fluids ;* **24**: No. 6, 1115-1125(Jun 1981).

The dynamics of electrons in a low-frequency wave propagating perpendicular to a uniform magnetic field are studied and the implications of these results for transport and heating by the lower hybrid drift instability are explored. Below a threshold ef/T/sub i/roughly-equal 0.25—1.0, all electron energy exchange with the wave is reversible and no plasma transport is possible. Above this threshold, trapping of electrons by the wave potentials takes place and causes irreversible electron heating and diffusion. These results imply that anomolous transport in inhomogeneous plasma with weak drifts (diamagnetic velocity less than the ion thermal velocity) may be substantially less than previously predicted.

**22896 Spectroscopic study of stimulated Brillouin scattering.** Turechek, J.J.; Chen, F.F. (Electrical Sciences and Engineering Department, University of California, Los Angeles, California 90024). ER-76-5-03-0034,P.A.236. *Physics of Fluids ;* **24**: No. 6, 1126-1141(Jun 1981).

Results are summarized of a diagnostic study of underdense plasma targets, leading to the first observation of stimulated Brillouin scattering arising from thermal-level fluctuations. Included are; (1) a detailed analysis of spectroscopic measurements of the plasma before and during laser heating, (2) computer calculations of plasma evolution during the laser pulse, (3) observations and anlaysis of Brillouin scatter, and (4) spectroscopic observations of forbidden satellite line emission during Brillouin scatter.

**22897 Limiting beta of stellarators with no net current.** Strauss, H.R.; Monticello, D.A. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). DE-AC02-76CH03073. *Physics of Fluids ;* **24**: No. 6, 1148-1155(Jun 1981).

Using reduced nonlinear magnetohydrodynamic equations, finite beta, resistive l = 2 stellarator equilibria with no net current are found. Stability to low mode number internal magnetohydrodynamic modes is investigated, and beta limits comparable to tokamaks are found. Low shear equilibria appear to be substantially more stable than high shear.

**22898 Simulation of the formation of the PS-1 spheromak.** Sgro, A.G.; Winske, D. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). DE-AC05-79ET53044. *Physics of Fluids ;* **24**: No. 6, 1156-1163(Jun 1981).

Several interesting characteristics of the PS-1 spheromak plasma have been inferred from one-dimensional simulations of the implosion phase of the experiment. The calculations demonstrate that metallic impurities in the pre-imploded plasma, which come from the electrodes, strongly affect the dynamics of the implosion. The simulations also indicate that the resistivity and Joule heating are much larger than their classical values, suggesting that microinstabilities are a principal source of ion heating. Finally, the calculations suggest the existence of a hot, low-density plasma between the plasma column and the wall, which carries a non-negligible fraction of the poloidal current.

**22899 Quasi-linear diffusion and radial transport in tokamaks.** Hazeltine, R.D.; Mahajan, S.M.; Hitchcock, D.A. (Fusion Research Center, The University of Texas at Austin, Austin, Texas 78712). DE-AC05-76ET-53036. *Physics of Fluids ;* **24**: No. 6, 1164-1179(Jun 1981).

An important difference between the classical collision operator, C(f), and Kaufman's quasi-linear diffusion operator in action space, D(f), is that only the former conserves particles, momentum, and energy at each spatial point. The nonlocal character of action-space diffusion allows all transport fluxes to be expressed directly in terms of appropriate moments of D. Thus, a general description of quasi-linear diffusion and convection across flux surfaces in any collisionless, axisymmetric toroidal system is obtained, in terms of scale factors relating the invariant surfaces to the flux surfaces. Several analogues to the neoclassical problem are apparent, including the collisionless version of the Ware—Galeev pinch effect, whose derivation in action space is especially straightforward. Toroidicity modifies not only particle orbits but also the spatial structure of the fluctuations, and both modifications affect the resulting transport in an important way. The use of appropriate action-angle variables automatically includes the orbital effects; crucial features of the toroidal eignmode structure are incorporated by use of the ballooning representation. This makes the fastest radial variation explicit, in terms of a single parameter describing the degree to which submodes localized on different rational surfaces overlap. The variation on slower length scales, and the overall spectral amplitude, are not determined. The radial particle flux corresponding to a Maxwellian distribution function is displayed and its dependence on properties of the spectrum is analyzed.

**22900 Auger analysis of surface deposits formed by exposure to plasma discharges in Doublet III.** Smith, J.N. Jr.; Meyer, C.H. Jr. (General Atomic Company, San Diego, California 92138). DE-AT03-76ET51011. *Journal of Vacuum Science and Technology, The ;* **19**: No. 1, 63-71(May 1981).

A new sample transfer and analysis station, incorporating modular design features, is utilized in an initial series of studies of surface deposits produced by tokamak discharges in Doublet III. A

functional description of the new apparatus is given in addition to a summary of the results of semi-quantative Auger analysis of surface deposits formed over the course of a 350 discharge period of tokamak operation, during which time Ti gettering was first employed. Excluding Ti, the deposit density can be inferred to be $\sim 2.3 \times 10^{14}$ atoms $cm^{-2}$ per discharge and to consist primarily of C, Ni, and O, in order of decreasing percentage. This is more than a factor of 2 less than the amount of deposition observed prior to the advent of gettering. The dominant plasma impurity radiation is associated with O.

22901 **Instability of the Brillouin-flow equilibrium in magnetically insulated structures.** Swegle, J.; Ott, E. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters ;* **46**: No. 14, 929-932(6 Apr 1981).

Presented herein is a fully electromagnetic and relativistic stability analysis of the Brillouin flow equilibrium for magnetic insulation in planar geometry. Instability of TM waves propagating in the direction of the sheared electron flow is found. This instability occurs at short wavelengths at frequencies above the cyclotron and plasma frequencies relevant to the system. It is found that relativistic effects can make the maximum instability growth rate normalized to the cyclotron frequency substantially lower than the nonrelativistic value (0.06).

22902 **Impurity studies in fusion devices using laser-fluorescence spectroscopy.** Husinsky, W.R. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). W-7405-ENG-26. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1054-1061(Apr 1981).

Resonance fluorescence excitation of neutral atoms using tunable radiation from dye lasers offers a number of unique advantages for impurity studies in fusion devices. Using this technique, it is possible to perform local time-resolved measurements of the densities and velocity distributions of metallic impurities in fusion devices without disturbing the plasma. Velocities are measured by monitoring the fluorescence intensity while tuning narrow bandwidth laser radiation through the Doppler-broadened absorption spectrum of the transition. The knowledge of the velocity distribution of neutral impurities is particularly useful for the determination of impurity introduction mechanisms. The laser fluorescence technique will be described in terms of its application to metallic impurities in fusion devices and related laboratory experiments. Particular attention will be given to recent results from the ISX-B tokamak using pulsed dye lasers where detection sensitivities for neutral Fe of $10^6$ atoms/$cm^3$ with a velocity resolution of 600 m/s (0.1 eV) have been achieved.

22903 **Compact torus.** Furth, H.P. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). DE-AC0Z-76-CH03073. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1073-1080(Apr 1981).

The objective of the compact torus approach is to provide toroidal magnetic-field configurations that are based primarily on plasma currents and can be freed from closely surrounding mechanical structures. Some familiar examples are the current-carrying plasma rings of reversed-field theta pinches and relativistic-electron "smoke ring" experiments. The spheromak concept adds an internal toroidal magnetic field component, in order to enhance MHD stability. In recent experiments, three different approaches have been used to generate spheromak plasmas: (1) the reversed-field theta pinch; (2) the coaxial plasma gun; (3) a new quasi-static method, based on the initial formation of a toroidal plasma sleeve around a mechanical ring that generates poloidal and toroidal fluxes, followed by field-line reconnection to form a detached spheromak plasma. The theoretical and experimental MHD stability results for the spheromak configuration are found to have common features.

22904 **ELMO Bumpy Torus: An alternate concept to tokamaks and mirrors.** Glowienka, J.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). W-7405-ENG-26. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1088-1097(Apr 1981).

The ELMO Bumpy Torus (EBT) is a hybrid magnetic trap formed by a series of toroidally connected simple mirrors. It differs from a tokamak, the present mainline approach, in that plasma stability and heating are obtained in a current-free geometry by the application of steady-state, high-power, electron cyclotron resonance heating (ECH) producing a steady-state plasma. The primary motivation for EBT confinement research is the potential for a steady-state, highly accessible reactor with high beta. In the present EBT-I/Scale device (EBT-I/S), electron confinement has been observed to agree with the predictions of theory. The major emphasis of the experimental program is on the further scaling of plasma parameters in the EBT-I/S machine with ECH frequency (10.6, 18, and 28 GHz), resonant magnetic field (0.3, 0.6, and 1 T), and heating power (30, 60, and 200 kW). In addition, substantial efforts are under way or planned in the areas of ion cyclotron heating, neutral beam heating, plasma-wall interactions, impurity control, synchrotron radiation, and divertors. Recently, EBT has been selected as the first alternate concept to be advanced to the proof-of-principle stage; this entails a major device scale-up to allow a reasonable extrapolation to a DT-burning facility. The status and future plans of the EBT program, in particular the EBT proof-of-principle experiment (EBT-P), are discussed.

## 7002 Fusion Power Plant Technology

*REFER ALSO TO CITATION(S) 21811, 22305, 22426, 22434, 22435, 22449, 22881*

22905 **(DOE/DP/40003—T1) Theoretical studies of plasma turbulence and hydrodynamic instability in fusion targets.** Morse, R.L. (Arizona Univ., Tucson (USA)). Nov 1979. Contract AS08-77DP40003. 92p. NTIS, PC A05/MF A01.

Separate abstracts were prepared for each of the 3 included papers. (MOW)

22906 (DOE/DP/40003—T1, pp 5p, Paper 1) **Structure and observable characteristics of laser driven ablation.** Matzen, M.K. (Sandia Labs., Albuquerque, NM); Morse, R.L. Nov 1979. NTIS, PC A05/MF A01.

In Theoretical studies of plasma turbulence and hydrodynamic instability in fusion targets.

Numerical hydrodynamic-heat flow simulations of spherical ablation have been done with sufficient spatial resolution to show the details of the ablation front structure. These simulations show a continuous qualitative change in the velocity spectrum of expanding ions with increasing laser pulse length, ranging from approximately isothermal behavior from short pulse to ablative behavior from longer pulses. The ablative behavior is characterized by an energetic peak in the ion spectrum, a characteristic of ablation that is experimentally observable. The longer pulse cases are found to be in good agreement with the stationary flow model of ablation.

22907 (DOE/DP/40003—T1, pp 72p, Paper 2) **Stationary flow model of ablatively imploded spherical shells.** Montierth, L.; Morse, R. (Univ. of Arizona, Tucson). Nov 1979. NTIS, PC A05/MF A01.

In Theoretical studies of plasma turbulence and hydrodynamic instability in fusion targets.

The stationary flow model of spherical ablation is extended to shells, solutions with a density discontinuity at the critical surface, and charged particle beam driven ablation. Parameter studies of the shell solutions show the relationship between shell aspect ratio, relative ablative mass removal or burn thru, laser power, and shell material type. The discontinuous solutions are shown to occur when the critical surface and sonic surface coalesce. The relationship of these solutions to particular physical situations is shown to be ambiguous in a way that must be resolved by microscopic transport calculations. Charged particle driven ablative implosion processes are shown to resemble laser driven ablation. However, qualitatively different ablation processes occur in different regimes of the power and range of the incident beam. Procedures are described by which stationary solutions can be used to interpret and predict the results of experiments and numerical simulations.

22908 (DOE/DP/40003—T1, pp 31p, Paper 3) **Taylor instability in fusion targets.** McCrory, R.L. (Univ. of Rochester, NY); Montierth, L.; Morse, R.L.; Verdon, C.P. Nov 1979. NTIS, PC A05/MF A01.

In Theoretical studies of plasma turbulence and hydrodynamic instability in fusion targets.

Optimum performance in laser driven fusion targets is enhanced by the use of high aspect ratio shells in commonly employed spherically symmetric designs. Taylor instability occurs in these systems at (1) the ablation surface when the acceleration is in the same direction as the local density gradient, and (2) later in the implosion process when the fuel decelerates the pusher. Results for a linear stability analysis of the ablation-driven Taylor instability are obtained from a perturbation analysis of the two parameter stationary ablative flow model. The linear growth rates are shown to be in agreement with full two-dimensional numerical simulations. From the linear analysis, the potentially most damaging unstable mode is identified, and full two-dimensional numerical simulations are performed. The two-dimensional calculations determine the nature and saturation behavior associated with the unstable mode. Our results indicate that saturation of the ablatively driven Taylor instability does occur. This saturation occurs at an amplitude which is sufficiently large to be a possible cause of difficulty in using large aspect ratio shells in fusion targets, but is seen to prevent these shells from breaking up and becoming turbulent. It appears plausible that such distorted but laminar, i.e. non-turbulent, shells could be successfully employed in fusion targets.

22909 **(DOE/DP/40012—T1) Generation and focusing of pulsed intense ion beams. Final progress report, April 1, 1979-September 30, 1979.** Sudan, R.N.; Hammer, D.A. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). Apr 1981. Contract AS02-77DP40012. 31p. NTIS, PC A03/MF A01.

Theoretical calculations suggest that an intense pulsed ~ 1 MeV proton beam can be used to simulate the characteristics of ~ 1 GeV heavy ion beam propagation in an inertial confinement fusion reactor chamber. Given the present availability of the former beams and the high projected cost for obtaining the latter ones, such experimental simulations appear appropriate. Work was undertaken under the cited contract to apply the technology of intense proton beams to this end. The first task was the development of a high brightness pulsed proton source which could produce a weakly convergent ~ 10 kA proton beam in a field free drift region. This was accomplished at ~ 250 keV, and preliminary beam propagation experiments were performed. It was concluded that a proper simulation experiment would require a higher voltage beam. An upgraded version of the existing generator, which would have produced a 30 kA beam at about 500 keV, and further propagation experiments were proposed as part of our unsuccessful renewal proposal dated October 15, 1979.

22910 **Economic impact of a laser-fusion breeder on the U.S. energy economy.** Goldman, L.M. (Univ. of Rochester, NY). *AIChE (American Institute of Chemical Engineers) Symposium Series ;* **75**: No. 191, 196-200(1977). (CONF-771102—).

From 70. annual AICHE meeting; New York, NY, USA (13 Nov 1977).

By including the best estimates of costs for a laser fusion breeder reactor into an econometric model of the U.S. energy economy, it is shown that such a breeder might have a very significant effect even for rather conservative estimates for the performance of the new breeder. 7 refs.

22911 **(DOE/ER/52071—T1) Microwave plasma source for neutral-beam injection systems. Quarterly technical progress report.** (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). 13 May 1981. Contract AC03-81ER52071. 5p. NTIS, PC A02/MF A01.

Conceptual design studies of a cusp field rf ion source are described. A diagram of the thruster is given. (MOW)

22912 **(HEDL-SA—2253) Simulation of the fusion materials irradiation test facility lithium and heat transport systems for abnormal events study.** Carlson, W.F.; Elyashar, N.N. (Hanford Engineering Development Lab., Richland, WA (USA)). 10 Feb 1981. Contract AC14-76FF02170. 21p. (CONF-810701—3). NTIS, PC A02/MF A01.

From Computer simulation conference; Washington, DC, USA (15 Jul 1981).

A digital computer model of Fusion Materials Irradiation Test Facility's heat transport system has been developed. The model utilizes a set of coupled differential equations to simulate the dynamic behavior of the primary and secondary heat transport loop systems. The model has been used to investigate the stability of the proposed control schemes for lithium temperature and flow rate and for an extensive study of equipment failures and malfunction analysis. It was determined that certain equipment failures and malfunctions in the primary loop require a response from the control system within less than one second of the occurrence of the failure. The effects of equipment failures in the secondary loop were found to be less dramatic than the equivalent failures in the primary loop. The failures in the secondary loop generally required control action in time frames of the order of minutes.

22913 **(LA-UR—81-1229) Opto-mechanical devices for the Antares automatic beam alignment system.** Swann, T.; Combs, C.; Witt, J. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 22p. (CONF-810429—12). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

Antares is a 24-beam $CO_2$ laser system for controlled fusion research, under construction at Los Alamos National Laboratory. Rapid automatic alignment of this system is required prior to each experimental shot. Unique opto-mechanical alignment devices, which have been developed specifically for this automatic alignment system, are discussed. A variable focus alignment telescope views point light sources. A beam expander/spatial filter processes both a visible Krypton Ion and a 10.6 $\mu$m $CO_2$ alignment laser. The periscope/carousel device provides the means by which the alignment telescope can sequentially view each of twelve optical trains in each power amplifier. The polyhedron alignment device projects a point-light source for both centering and pointing alignment at the polyhedron mirror. The rotating wedge alignment device provides a sequencing point-light source and also compensates for dispersion between visible and 10.6 $\mu$m radiation. The back reflector flip in remotely positions point-light sources at the back reflector mirrors. A light source box illuminates optic fibers with high intensity white light which is distributed to the various point-light sources in the system.

22914 **(LA-UR—81-1245) In-situ optical breakdown: studies for a large $CO_2$ laser amplifier.** Elliott, C.J.; Bjurstrom, R.G.; Carpenter, J.P.; Coffelt, E.L.; Hayden, J.J.; Hebron, D.E.; McLeod, J.; Romero, V. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 4p. (CONF-810429—13). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

We study optical breakdown from target reflected optical pulses in the Gemini laser system. We measure the retropulse fluence (or illuminance) leaving the amplifier in terms of the energy entering the breakdown region and find qualitative agreement but no quantitative agreement with theory. Particulates were observed on nucleopore filters through which gas samples were drawn.

22915 **(LA-UR—81-1394) Antares alignment gimbal positioner.** Day, R.D.; Viswanathan, V.K.; Saxman, A.C.; Lujan, R.E.; Woodfin, G.L.; Sweatt, W.C. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 7p. (CONF-810429—28). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

Antares is a 24-beam 40-TW carbon-dioxide ($CO_2$) laser fusion system currently under construction at the Los Alamos National Laboratory. The Antares alignment gimbal positioner (AGP) is an optomechanical instrument that will be used for target alignment and alignment of the 24 laser beams, as well as beam quality assessments. The AGP will be capable of providing pointing, focusing, and wavefront optical path difference, as well as aberration information at both helium-neon (He-Ne) and $CO_2$ wavelengths. It is designed to allow the laser beams to be aligned to any position within a 1-cm cube to a tolerance of 10 $\mu$m.

**22916 (LA-UR—81-1404) Temporal shaping of nanosecond $CO_2$ laser pulses in multiphoton saturable absorbers.** Haglund, R.F. Jr. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 23p. (CONF-810429—29). NTIS, PC A02/MF A01.

From Conference on optics; Santa Fe, NM, USA (6 Apr 1981).

It was shown that substantial temporal distortion of nanosecond 10.6 $\mu$m laser pulses occurs in traversing multiphoton saturable absorbers. The risetime and pulse delay effects appear to depend both on fluence and wavelength, and to be qualitatively consistent with predictions of a simple two-level absorption model.

**22917 (LA-UR—81-1408) Method of active charge and current neutralization of intense ion beams for ICF.** Guiragossian, Z.G.T.; Orthel, J.L.; Lemons, D.S.; Thode, L.E. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA); Los Alamos National Lab., NM (USA)). 1981. Contract AC08-79DP40109;W-7405-ENG-36. 5p. (CONF-810314—160). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Methods of generating the beam neutralization electrons with required properties are given in the context of a Light Ion Fusion Experiment (LIFE) designed accelerator. Recently derived envelope equations for neutralized and ballistically focused intense ion beams are applied to the LIFE geometry in which 10 MeV $He^+$ multiple beamlets coalesce and undergo 45:1 radial compression while beam pulses experience a 20:1 axial compression in the propagation range of 10 m. Both active and auto-neutralization methods are examined and found to produce initial electron temperatures consistent with the requirement of the envelope equation for both radial and axial adiabatic beam pulse compressions. The stability of neutralized beam propagation is also examined concerning the Pierce type electrostatic instability and for the case of LIFE beams it is found to have insignificant effect. A scaled experimental setup is presented which can serve to perform near term tests on the ballistically focused propagation of neutralized light ion beams.

**22918 (PPPL—1790) Bow-shaped toroidal field coils.** Bonanos, P. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1981. Contract AM02-76CH03023. 8p. NTIS, PC A02/MF A01.

Design features of Bow-Shaped Toroidal Field Coils are described and compared with circular and D shaped coils. The results indicate that bow coils can produce higher field strengths, store more energy and be made demountable. The design offers the potential for the production of ultrahigh toroidal fields. Included are representative coil shapes and their engineering properties, a suggested structural design and an analysis of a specific case.

**22919 (UCID—18983) Tandem-mirror program: status and projection.** Van Atta, C.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Mar 1981. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01.

Construction of MFTF-B is scheduled for completion in 1985. Results of experiments in TMX-U and MFTF-B will permit the design of the D-T burning tandem-mirror next-step facility (TMNS) in which physics issues will not be at issue. TMNS will be a facility for engineering research and development. The end cells of TMNS are expected to be appropriate for a tandem-mirror demonstration fusion reactor (TMR), construction of which should begin about 1986 for operation in the 1990's.

**22920 (UCRL—52000-81-6) Energy and technology review.** Weissenberger, S.; Crawford, R.B.; Esser, M.A.; Lien, P.L.; Madsen, K. (eds.). (Lawrence Livermore National Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01.

Some research programs at Lawrence Livermore Laboratory are described. These include performance results from the tandem mirror experiment for thermonuclear reactor design, tandem mirror end plugs for future fusion reactors, and verifying compliance with the test ban treaties. (GHT)

**22921 Material selection for TFTR limiters.** Ulrickson, M. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08544). DE-AC02-76-CHO-3073. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1037-1045(Apr 1981).

Requirements for the material to be used as the first surface of limiters in TFTR are to (1) withstand a heat flux of 1 kW/cm$^2$ for a pulse length of 1.5 s and a duty cycle of 1/200 for $10^5$ cycles, (2) withstand the thermal and electromagnetic loads from $10^4$ plasma current disruptions lasting about 200 ms, (3) generate impurities at a rate low enough to meet impurity control requirements (which depend on the atomic number of the material) for TFTR, and (4) have tritium retention characteristics consistent with tritium inventory requirements for TFTR. An extensive set of material tests using electron beams, neutral beams, and plasma bombardment have been carried out to identify materials which can meet the thermal requirements of (1) and (2) above. In most cases these tests have been combined with calculations of the expected thermomechanical response of the material to determine the reasons for the result observed. These studies have identified two major classes of materials which are acceptable: (1) graphite which is coated to control hydrocarbon formation and (2) copper cladded with a lower sputtering yield material.

**22922 Gas release studies from explosion-cladded materials.** Craig, J.H. Jr. (Department of Physics, University of Nebraska at Omaha, Omaha, Nebraska 68182). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1046-1048(Apr 1981).

Gas release studies have been conducted on five explosion cladded materials which are of potential use in protection of fusion reactor first wall components. Both one and two layer claddings on OFHC Cu were studied at room temperature, 100 °, and 250 °C. Total outgassing rate and mass analysis experiments were conducted. For purposes of comparison, a 304 LN stainless steel sample was also analyzed. Results indicated comparable outgassing rates for the stainless steel and cladded samples at room temperature, but substantially higher outgassing rates at 250 °C for the cladded samples.

**22923 Mechanical properties of chemical vapor deposited coatings for fusion reactor application.** Mullendore, A.W.; Whitley, J.B.; Pierson, H.O.; Mattox, D.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-76-DP00789. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1049-1053(Apr 1981).

Chemical vapor deposited coatings of $TiB_2$, TiC and boron on graphite substrates are being developed for application as limiter materials in magnetic confinement fusion reactors. In this application severe thermal shock conditions exist and to do effective thermo-mechanical modelling of the material response it is necessary to acquire elastic moduli, fracture strength, and strain to fracture data for the coatings. Four point flexure tests have been conducted from room temperature to 2000 °C on $TiB_2$ and boron coated graphite with coatings in tension and compression and the mechanical properties extracted from the load-deflection data. In addition, stress relaxation tests from 500 ° to 1150 °C were performed on $TiB_2$ and TiC coated graphite beams to assess the low levels of plastic deformation which occur in these coatings. Significant differences have been observed between the effective mechanical properties of the coatings and literature values of the bulk properties.

**22924 Hydrogen isotope analysis by quadrupole mass spectrometry.** Ellefson, R.E.; Moddeman, W.E.; Dylla, H.F. (Monsanto Research Corporation, Mound Facility, Miamisburg, Ohio 45342). Contract DE-AC0476-DP0053J;DE-AC02-76-CH03073. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1062-1067(Apr 1981).

The analysis of isotopes of hydrogen (H,D,T) and helium ($^3$He,$^4$He) and selected impurities using a quadrupole mass spectrometer (QMS) has been investigated as a method of measuring the purity of tritium gas for injection into the Tokamak Fusion Test Reactor (TFTR). A QMS was used at low resolution, $m/Dm < 150$, for quantifying impurities from $m/q = 2$ to 44, and at medium resolution, $m/Dm \sim 600$, for determining concentrations of HD in

$^3He$, and $^4He$ in $HT/D_2$. Sample gases to be studied were introduced into the QMS housing through a molecular leak from a 3-liter inlet volume. A linear relation between peak height (and area) and component partial pressure was verified and QMS sensitivities for various ions were determined. Increases in background hydrocarbon and water vapor were measured whenever hydrogen (any isotope) was present in the QMS housing. Baking and $H_2$ glow discharge conditioning (GDC) minimized these effects. Low resolution, computer-controlled QMS analysis of $D_2$ and $T_2$ standard mixtures after $H_2$/GDC treatment demonstrated the capability to verify tritium purity at the 98 at.% level as required in the TFTR application. Detection limits quoted were 0.005 mol.% for Ar; 0.02 mol.% for $CT_4$, $0_2$ and $CO_2$; 0.05 mol.% $N_2/CO$; and between 0.03 and 0.25 mol.%, depending on the sample, for hydrogen and helium species.

**22925 ETF reactor design status.** Sager, P.H. (General Atomic Company, Nuclear Systems Branch, ETF Design Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). DE-AT03-76ET51011. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1081-1087(Apr 1981).

Conceptual design studies of a tokamak Engineering Test Facility (ETF) are being carried out as a joint laboratory—industry effort at the ETF Design Center at Oak Ridge National Laboratory (ORNL). Designs are being developed for two reactors, one with a bundle divertor and one with a poloidal divertor. These machines, which are designed for ignition and a burn time of 100 s, both have a major radius of 5.4 m, a plasma minor radius of 1.3 m, and a D-shaped plasma elongation ratio of 1.6. The plasma chamber must be conditioned at $10^{-7}$ Torr ($10^{-5}$ Pa). During the 13 s dwell between burns, the chamber must be pumped down from 3 x $10^{-4}$ to 3 x $10^{-5}$ Torr. In the design with the bundle divertor, four pairs of compound cryopumps, each pump with a 4 $m^2$ cryosorption pumping surface, are installed to pump down the plasma chamber. In the design with the poloidal divertor, the plasma chamber is evacuated with the ten pairs of compound cryopumps, each pump with a cryosorption pumping surface of 13 $m^2$, installed to handle the divertor load. In both cases the pumps are installed in pairs so that one set can be regenerated while the other set is on-line.

**22926 Co adsorption on Al-Zr at room temperature.** Wu, C.H.; Moore, R.L.; Cohen, S.A. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). DE-AC02-76-CHO3073. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1098-1101(Apr 1981).

A study of CO adsorption on room temperature Al—Zr has been done using Auger electron spectroscopy and gas pressure measurements. The atomic surface composition of clean Al—Zr surfaces prepared in UHV by $Ar^+$ sputtering was measured as a function of CO pressure and exposure time. The adsorbed C and O have the same rate constants and surface concentrations for exposures less than 2 Langmuir. Above this exposure quasi-saturation occurs. The measured sticking probability of CO on Al—Zr is constant, S = 0.7 +- 0.3, for fractional coverage q< or ≈0.5. Above this point S decreased rapidly. The effect of surface roughness on the apparent sticking coefficient has been calculated by a Monte Carlo simulation. Reactivation of Al—Zr by heat treatment to 700 °C has also been studied.

**22927 Titanium gettering in Doublet III.** deGrassie, J.S.; Callis, R.; Campbell, G.; Garcia, J.; Ledin, E.; Meyer, C.; Miller, J.; Petersen, P.; Smith, J.; Stav, R.; Taylor, T.; Group, T.D.I.; Nagami, M.; Group, T.J. (General Atomic Company, San Diego, California 92138). DEAT-0376ET51011;DEAT0380ET51019. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1102-1105(Apr 1981).

The application of mild titanium gettering in the Doublet III tokamak has led to a significant improvement in the obtainable operating regimes and discharge parameters for all of the many plasma cross-sectional shapes studied. With gettering, low-Z impurities and radiated power are greatly reduced. The maximum line average electron density has increased 50% (n-bar/sub e//sub max/ ~1 x $10^{20}/m^3$), corresponding to a Murakami coefficient of nearly six.

**22928 Thermal decomposition of Ti getter films from the DITE tokamak.** Malinowski, M.E. (Sandia National Laboratories, Livermore, California 94550). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1106-1110(Apr 1981).

The potential application of Ti gettering in tritium-using tokamaks will result in unacceptably high in-torus tritium inventories if the tritium cannot be recovered from the Ti thin films. To help assess the feasibility of tritium recovery by outgassing such films, several samples of getter films evaporated in the DITE tokamak were thermally decomposed in vacuum. Film samples from four different azimuthal torus positions were heated at ~$1^0C\ s^{-1}$ and all exhibited decomposition rate peaks at $410^0$ +- $10^0C$; every film had been fully decomposed by the time 475°C was reached. Separate experiments showed that isothermal desorption at temperatures as low as 350°C was sufficient to outgas such films in 10 min. Together with previous work on clean films, the present results indicated that films which have not been as heavily contaminated as the DITE samples could be desorbed in vacuum at temperatures between 250—350°C in acceptably short times, and demonstrate that in situ outgassing of tritided films would be feasible.

**22929 Effect of hydrogen glow discharge conditioning on Zr/Al getter pumps.** Dylla, H.F.; Cecchi, J.L.; Ulrickson, M. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). DE-AC02-76-CH0-3073. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1111-1113(Apr 1981).

Zr/Al bulk getter pumps are presently being considered for use in the Tokamak Fusion Test Reactor (TFTR) to reduce impurities and limit the recycling of hydrogenic species. It is necessary that these pumps not be adversely affected by the hydrogen glow discharge cleaning (GDC) which is planned as part of the routine TFTR vessel wall conditioning. The GDC procedure involves the use of a dc glow discharge with a 400 V bias voltage. The total fluence of hydrogenic ions given to the affected surfaces during a typical conditioning period is $10^{18}\ cm^{-2}$. We have investigated the effects of typical GDC runs on a getter-pump module containing 25 g of Zr/Al mounted in a 100 liter test stand. Pumping speed, capacity, and regeneration characteristics have been studied after various exposures to GDC.

**22930 Nonevaporable getter for ion beam fusion.** Moenich, J.S. (Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1114-1116(Apr 1981).

Eddy current effects limit wall thickness of stainless steel chambers in the bending magnet areas of accelerators. Distributed ion pumps are not applicable because of magnetic cycles of these bending magnets. Differential pumping permits applicable inner chamber design but complicates baking and appendage pump mounting. A nonevaporable getter distributed pumping technique (1) is not affected by the magnetic cycle of bending magnets, (2) will provide a minimum of four times the hydrogen speed of appendage ion pumps, (3) will require no power during pumping after strip is activated, (4) will provide the heat source for bakeout, (5) is easily replaceable, and (6) can be purchased, installed, and operated at a generous economic advantage over a completely ion pumped system.

**22931 TSTA compound cryopump.** Batzer, T.H.; Patrick, R.E.; Call, W.R. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). W-7405-ENG-48. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1125-1130(Apr 1981).

The Tritium System Test Assembly (TSTA), at the Los Alamos Scientific Laboratory, is intended to demonstrate realistic fuel supply and cleanup scenarios for future fusion reactors. The vacuum pumps must be capable of handling large quantities of reactor exhaust gases consisting largely of mixtures of hydrogen and helium isotopes. Cryocondensing pumps will not pump helium at 4.2 K; while cryosorption pumps using molecular sieves or charcoal have good helium pumping speed, the adsorbent clogs with condensed hydrogen while pumping mixtures of both. A solution to this problem is a compound design whereby the first stage condenses the hydrogen species and the second, or sorption, stage pumps the helium. The TSTA pump designed at Lawrence Liver-

more National Laboratory uses argon gas to cryotrap the helium in the helium—hydrogen mixture. The argon is sprayed directly onto the 4.2 K surface at a rate proportional to the helium flow rate, permitting continuous pumping of the helium—hydrogen mixtures in a single-stage pump. However, the possibility of differential desorption as a first stage in the TSTA gas separation cycle required the inclusion of a first-state hydrogen isotope condenser. The design, performance, and operating characteristics are discussed.

22932 **Doublet III neutral beam cryopumping system.** Otavka, M.A.; Colleraine, A.P.; Holland, M.M.; Kim, J. (General Atomic Company, San Diego, California 92121). DE-AM03-76SF0016T CATEGORY NO. 4. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1136-1139(Apr 1981).

Two neutral beamlines, each capable of injectingroughly-equal 3.6 MW $H^0$ beam of 80 keV, are employed for the upcoming neutral beam injection heating experiments in Doublet III tokamak. The large influx of hydrogen gas in a beamline is pumped by a sophisticated system of cryopanels that are cooled by a closed-loop forced flow of liquid helium. Two cryopanels per beamline at subcooled liquid helium temperatures provide a combined pumping speed of over $10^6$ l/s. The system of cryopanels, transfer lines, and a liquifier is described, together with preliminary test results in the actual beamline.

22933 **Solid-state processes to produce hemispherical components for inertial fusion targets.** Wise, K.D.; Robinson, M.G.; Hillegas, W.J. (Electron Physics Laboratory, Department of Electrical and Computer Engineering, University of Michigan, Ann Arbor, Michigan 48109). DE-AC08-78DP40030. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1179-1182(Apr 1981).

The designs proposed for next-generation targets and components for inertial fusion (IF) involve complex multilayer, multishell configurations. Solid-state process technology offers a wide assortment of fabrication techniques useful in the realization of such structures. This paper presents several such processes which are capable of producing freestanding hemishells of a variety of materials.

22934 **Double-shell inertial confinement fusion target fabrication.** Hatcher, C.W.; Lorensen, L.E.; Weinstein, B.W. (Lawrence Livermore National Laboratory, P. O. Box 5508, Livermore, California 94550). W-7405-ENG-48. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1187-1190(Apr 1981).

Double-shell targets may be required for the next generation of inertial confinement fusion targets since the energy available for driving the implosion is limited with current drivers. The use of double-shell targets to provide a velocity multiplication driven implosion is an alternative to increased driver energy. First generation hemishells, from which spherical shells are constructed, were fabricated by micromachining coated mandrels and by molding. The remachining of coated mandrels will be described in detail in this article. Techniques were developed for coating the microsized mandrels with polymeric and metallic materials by methods including conformal coating, vapor deposition, plasma polymerization and thermoforming. Micropositioning equipment and bonding techniques have also been developed to assemble the hemishells about a fuel pellet maintaining a spherical concentricity of better than 2 mm and voids in the hemishell bonding line of a few hundred angstroms or less.

22935 **Interferometric measurements of multilayer and double-shell inertial fusion targets.** Weinstein, B.W.; Weir, J.T.; Willenborg, D.L. (Lawrence Livermore National Laboratory, P. O. Box 5508, Livermore, California 94550). W-7405-ENG-48. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1191-1194(Apr 1981).

Optical interference microscopy plays an important role in the measurement of targets for inertial confinement fusion experiments. We describe how these techniques are applied to the measurement of thickness and refractive index of multilayer films on both flat substrates and microsphere targets. We also discuss procedures for manipulating and examining microsphere targets to measure surface defects and wall thickness variations anywhere on the target. Finally, we describe the use of optical interferometry to measure the individual components and final assembled structure of double-shell targets. The accuracy of these measurements is from 0.03 to 0.05 mm, depending on the specific application.

22936 **Cleaning procedure for inertial fusion targets.** Farnum, E.; Gutacker, A.R.; Mulford, R. (University of California, Los Alamos National Laboratory, P.O. Box 1663 Los Alamos, New Mexico 87545). W-7405-ENG-36. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1195-1197(Apr 1981).

We describe a method for cleaning microshells used for inertial fusion targets. Six stages of aqueous cleaning use Reagent grade water and commerical detergents in ultrasonically agitated baths. Further treatment with ultraviolet light and ozone gas (UV/ozone) is used to remove all traces of organic contaminant. Glass microshells cleaned with this technique show no surface contamination larger than 0.1mm as analyzed by scanning electron microscopy.

22937 **Metallic coating of microspheres.** Meyer, S.F. (University of California, Lawrence Livermore National Laboratory, P.O. Box 5508, Livermore, California 94550). W-7405-ENG-48. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1198-1204(Apr 1981).

Extremely smooth, uniform metal coatings of micrometer thicknesses on microscopic glass spheres (microspheres) are often needed as targets for inertial confinement fusion (ICF) experiments. The first part of this paper reviews those methods used successfully to provide metal coated microspheres for ICF targets, including magnetron sputtering with microsphere bouncer and gas levitator, electro- and electroless plating, and chemical vapor deposition with fluidized bed. The second part of this paper discusses some of the critical aspects of magnetron sputter coating of microspheres, including substrate requirements, the sticking of microspheres during coating (preventing uniform coating), and the difficulties in growing the desired dense, smooth, uniform microstructure on continuously moving spherical substrates.

22938 **Recent advances in Pt coating of microspheres by a batch magnetron sputtering process.** Hsieh, E.J.; Meyer, S.F. (Lawrence Livermore National Laboratory, P.O. Box 5508, Livermore, California 94550). W-7405-ENG-48. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1205-1208(Apr 1981).

Some proposed inertial confinement fusion targets require high-Z, high density metal coatings on glass microspheres. Platinum, which satisfies the high-Z and density requirements, can be coated onto microspheres with a batch magnetron sputtering process incorporating oxygen as a dopant gas to prevent the microspheres from sticking. This paper outlines recent progress in three areas: First, the coating process has been improved; second, the oxygen content and resistivity of the oxygen doped platinum films are analyzed; and third, the roles oxygen may play in reducing microsphere sticking during sputtering are discussed in regard to cold welding, Van der Waals bonding, electrostatic sticking, and sintering.

22939 **Metal coatings for laser fusion targets by electroplating.** Illige, J.D.; Yu, C.M.; Letts, S.A. (Lawrence Livermore National Laboratory, P.O. Box 5508, Livermore, California 94550). *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1209-1213(Apr 1981).

Metal coated laser fusion targets must be dense, uniform, spherically symmetric to within a few percent of their diameters, and smooth to better than a few tenths of a micron. Electroplating offers some unique advantages including low temperature deposition, a wide choice of elements, and substantial industrial plating technology. We have evaluated electroless and electroplating systems for gold and copper, identified the factors responsible for small grain size, and plated glass microspheres with both metals to achieve smooth surfaces and highly symmetric coatings. We have developed plating cells which sustain the microspheres in continuous random motion during plating. We have established techniques for deposition of the initial conductive adherent layer on the glass microsphere surface. Coatings as thick as 15 mm have been made. The equipment is simple, relatively inexpensive, and may be adopted for high volume production of laser fusion targets.

**22940 Acoustic microscopy for ICF target analysis.** Bongianni, W.L. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). W-7405-ENG-36. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1214-1217(Apr 1981).

By 1982, 10 mm walled targets will require thickness and diameter tolerances of better than +- 100 A over spot dimensions of 10—100 mm. Such targets will be multishell and/or opaque which eliminates optical phase microscopy and severely limits x-ray analysis. In principal, an acoustic phase microscope can provide the necessary resolution, provided the acoustic beam can be coupled to, and focused within, the confines of the wall. In this paper, a shear wave acoustic microscope with an electronically variable focal length is described. A computer code has been used to study the ray optics and diffraction of this design and a spot size with the required dimensions has been obtained.

**22941 Plastic coating of microsphere substrates.** Liepins, R.; Campbell, M.; Clements, J.S.; Hammond, J.; Fries, R.J. (University of California, Los Alamos Scientific Laboratory, P.O. Box 1663, Los Alamos, New Mexico 87545). W-7405-ENG36. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1218-1226(Apr 1981).

Microsphere coating techniques and results are described together with the criteria that must be met for successful production of targets. An overview of the work at Lawrence Livermore Laboratory, the University of Rochester Laboratory for Laser Energetics, KMS Fusion, Inc., Sandia Laboratory, and Rockwell—Rocky Flats Division is presented. A detailed overview of Los Alamos Scientific Laboratory work describes thick coatings, smooth-surface coatings, organometallic, graded-density and graded-Z coatings; as well as difficult to deposit metal-upon-plastic coatings.

**22942 Polymer shells by the droplet method.** Kool, L.B.; Nolen, R.L.; Sherwood, K.W. (KMS Fusion, Inc., P.O. Box 1567, Ann Arbor, Michigan 48106). DE-AC08-78DP40030. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1233-1237(Apr 1981).

An acoustically modulated fluid jet (AMFJ) is used to generate a stream of identical droplets of a polymer solution by the breakup of a column of polymer solution resulting from Rayleigh jet instabilities. Selected droplets from this stream are then charged and deflected by an electric field into a vertical furnace. As the solvent evaporates, a polymer bubble is formed which hardens into a shell by the time it reaches the bottom of the furnace. By varying the polymer, solvent, temperature, and droplet size, we have been able to make polymer shells with a wide range of selected diameters and aspect ratios. Using an AMFJ, we have produced various polymer shells with narrow distributions of diameters.

**22943 "Vacuum" layer double-shell cryogenic inertial fusion targets.** Simms, R.J.; Musinski, D.L.; Jacobs, R.B. (KMS Fusion, Inc. Ann Arbor, Michigan 48104). DE-AC08-78DP40030. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1238-1241(Apr 1981).

A double-shell cryogenic target has been suggested as a possible design for commercial Inertial Fusion (IF) reactors. Fabrication techniques have been developed to the point where these targets will soon be available for experimental evaluation. Heat transfer from the fuel container to the outer shell can be provided by a low-pressure exchange gas between the two shells. The pressure and mass of gas is controlled by both temperature and the selection of the exchange gas. In the temperature range of interest (10—35 K), helium, a noncondensable gas, permits only a variation of pressure. A condensable gas, however, allows a variation in both the pressure and the mass density within the gas between the shells. A general thermal model has been developed as a framework to evaluate the thermal characteristics of proposed candidate target designs and estimate their expected fuel-layer uniformity.

**22944 In situ seeding of high Z elements with glow discharge polymerized organic coatings.** Crawley, R.L.; Kool, L.B.; Nolen, R.L. (KMS Fusion, Inc., P.O.Box 1567, Ann Arbor, Michigan 48106). DE-AC08-78DPH40030. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1255-1257(Apr 1981).

Currently favored IF target designs include low Z coatings seeded with small amounts of high Z elements. A method for incorporating high Z elements into glow discharge polymerized (GDP) coatings is being investigated. In this method we have substituted an iodine atom onto the p-xylene molecule prior to GDP deposition. Chemical analysis, IR, and NMR of the resultant coating indicates up to 7 at.% incorporation of chemically bound iodine. Metallic sputter/GDP codeposition has been reported[1], and is being installed in our latest deposition system.

**22945 Analysis of x-ray emission and tritium content from glass Microshell inertial fusion targets.** Alexander, S.M.; Henderson, T.M. (Division of Materials Science, KMS Fusion Inc., Ann Arbor, MI 48106). DE-AC08-78DP40030. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1262-1263(Apr 1981).

The inertial fusion program requires knowledge of the amount of gas contained within Microshell targets. Beta particles from the decay of tritium in a DT-filled shell interact with the glass walls producing x-rays. Measurement of the intensity of the emitted x-rays yields information on tritium content and indirectly on total gas pressure in the shell. The x-ray yield is influenced by fill pressure, shell wall thickness, shell composition, and shell diameter. Experimental results have been obtained relating effects of fill pressure as well as glass composition on x-ray production. X-ray spectra have been obtained with a Si(Li) detector. A qualitative measure of glass composition is obtained from the spectra: Si, Na, Al, K, and Ca lines are clearly visible when present.

**22946 Microradiographic characterization of metal and polymer coated microspheres.** Singleton, R.M.; Weir, J.T. (Lawrence Livermore National Laboratory, P.O. Box 5508, Livermore, California 94550). W-7405-ENG-48. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1264-1267(Apr 1981).

X-ray microradiography is used to make measurements of opaque metal and polymer coatings on hollow glass microspheres which are used as laser fusion targets at the Lawrence Livermore National Laboratory. Metal coatings include platinum, tantalum, gold, copper, and beryllium where thicknesses range from 1 to 10 mm on 70 to 200 mm diameter mandrels. Contact film images are made with x-ray energies from 1 to 50 keV, depending on the material and geometry. The recorded x-ray images show the internal structure of the coatings which is not observable with optical and SEM techniques. The film images are digitized and directly measured using a small computer-based image analysis system. Wall thicknesses and nonconcentricity can be measured to within 0.3 mm, and diameters to within 1.5 mm.

**22947 Chemical durability improvement of glass shells.** Anderson, P.R.; Scott, L.A.; Rolen, J.J. (KMS Fusion, Inc., Ann Arbor, Michigan 48106). DE-ACO8-78DP40030. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1268-1271(Apr 1981).

High temperature chemical surface treatments have been used to improve the chemical durability and weatherability of spherical glass shells. The surface treatment consists of exposing heated glass shells to a mixture of sulfur dioxide, air and water vapor. A thin layer of the glass shell is dealkalized as a result of this treatment. The weatherability of treated alkali-silicate and alkali-calcia-silicate shells was improved, as determined qualitatively with the aid of a SEM. The chemical durability of silicate shells containing over 10 wt.% alkali but no calcia was improved by as much as a factor of thirty by the treatment. The chemical durability of glass shells was determined by analyzing the aqueous solutions used for extracting the constituents of the shells. Treated glass shells containing calcia showed greater resistance to dissolution in water than untreated glass shells of the same composition, even though the untreated shells were relatively durable.

**22948 Analysis of glass shell blowing gases from metal-organic gels.** Downs, R.L.; Ebner, M.A.; Homyk, B.D.; Nolen, R.L. (KMS Fusion,Inc.,P.O.Box 1567, Ann Arbor, Michigan 48106). DE-AC08-78DP-40030. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1272-1275(Apr 1981).

To develop better control of size, wall thickness, and shell quality, we have studied the physical and chemical transformations of metal-organic gels during heating, employing a number of thermal analytical techniques, such as pyrolysis-gas chromatography (PGC), pyrolysis-mass spectrometry (PMS), TGA, DTA, and hot stage microscopy. This work will be the basis for mathematical modeling of the shell blowing process. The residual blowing gases in the glass spheres and the volatile gas content of the metal-organic gels were analyzed. The effect of gel aging on these was also studied. The primary component of the residual gases in the spheres is 70%—80% carbon dioxide, with the balance oxygen and nitrogen; water has also been found in some cases. The potential volatiles in metal-organic gels depend on the aging history of the gel, and consist primarily of water, carbon dioxide, and a variety of organic species.

22949 **Furnace profile effects on glass shell formation.** O'Holleran, T.P.; Downs, R.L.; Homyk, B.D. (KMS Fusion, Inc., P. O. Box 1567, Ann Arbor, Michigan 48106). DE-AC08-78DP40030. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1276-1278(Apr 1981).

In the course of blowing glass shells in a furnace drop tower it has been observed that furnace temperature profile affects shell aspect ratio. Wall uniformity appears less sensitive to temperature profile as long as some minimum-time/temperature history is achieved for a given glass composition. Quantitative results will be reported from experiments wherein the furnace temperature profile is systematically varied and the resultant shells are statistically analyzed for aspect ratio and wall uniformity.

22950 **Tensile testing of glass microshells.** Milewski, J.; Marsters, R. (Los Alamos Scientific Laboratory, P.O. Box 1663, Los Alamos, New Mexico 87545). W-7405-ENG-36. *Journal of Vacuum Science and Technology, The ;* **18**: No. 3, 1279-1283(Apr 1981).

This report discusses two different techniques for tensile testing of glass microshells,a mechanical pulling testing technique and an internal pressurization burst testing technique. Higher tensile values are recorded when the mechanical pulling method is used which is attributed to the testing method. Loss of tensile strength due to air exposure corrosion was detected by these tensile methods.

22951 **Argon ion impact desorption cross sections of chlorine and carbon from nickel.** Pena, J.L.; Dieball, J.W.; Lichtman, D. (Physics Department, Surface Studies Laboratory, University of Wisconsin-Milwaukee, Wisconsin 53201). EY-76-5-02-2425. *Journal of Vacuum Science and Technology, The ;* **18**: No. 2, 566-569(Mar 1981).

Total desorption cross sections have been measured for Cl (s/sub Cl/) and C (s/sub C/) on Ni(111) by Argon ion bombardment for an incidence angle of 60 ° from the surface normal. For the bombardment an ion gun with low current density ($i_b \sim 1 \times 10^{-7}$ A $cm^{-2}$) at low system pressure ($\sim 10^{-9}$ Torr) was used. The detection was performed by AES and the data was sensitivity factor corrected. The AES analysis of the surface after adsorption showed that Ni, C, and Cl contributed to more than 95% of the atomic composition. With known $i_b$, it is possible to obtain s from the adsorbate signal vs ion bombardment time curve. For ion energies between 0.2 to 1.0 keV the measured values for s/sub Cl/ and s/sub C/ are 0.35—3.5 x $10^{-15}$ $cm^2$ and 0.9—75 x $10^{-17}$ $cm^2$, respectively.

22952 **Hydrogen permeation characteristics of aluminum-coated and aluminum-modified steels.** Van Denventer, E.H.; MacLaren, V.A.; Maroni, V.A. (Argonne Natl Lab, Ill). *Journal of Nuclear Materials :* **88**: No. 1, 168-173(Jan 1980). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

321-SS samples having /similar/4 /mu/m-thick partially-oxidized aluminum coatings were prepared using sputter-coating techniques. 430-SS containing /similar/2 wt% aluminum in solution in the bulk alloy was also used. The presence of aluminum in the bulk alloy is preferable to aluminum coating methods from the standpoint of developing high permeation reduction factors and assuring permeation barrier resiliency. 13 refs.

22953 **Large scale cryopumps for fusion power systems.** Hood, C.B.; Bonn, J.W. (CVI Corp, Columbus, Ohio). pp 155-161 of Cryogenic processes and equipment in energy systems conference, 1980. Toscano, W.M.; Longsworth, R.C.; Zimmermann, F.J.; Gottzmann, C.F. (eds.). New York, NY; American Society of Mechanical Engineers (1980).

From Cryogenic processes and equipment conference; San Francisco, CA, USA (19 Aug 1980).

Fusion devices based on the magnetic confinement of hydrogen plasmas require very large high vacuum pumping systems. The present paper describes a novel cryopump designed for the Mirror Fusion Test Facility at Lawrence Livermore Laboratory. Extensive Monte Carlo studies were made to arrive at the final design. 3 refs.

22954 **Cryogenic system for the mirror fusion test facility.** VanSant, J.H.; Slack, D.S.; Nelson, R.L. (Lawrence Livermore Lab, Calif). pp 181-185 of Cryogenic processes and equipment in energy systems conference, 1980. Toscano, W.M.; Longsworth, R.C.; Zimmermann, F.J.; Gottzmann, C.F. (eds.). New York, NY; American Society of Mechanical Engineers (1980).

From Cryogenic processes and equipment conference; San Francisco, CA, USA (19 Aug 1980).

This paper describes the LHe cryopumping and magnet systems. Principal components include a 3300 W helium refrigerator, 30,000 L LHe storage, a 1.5 MW (2000 hp) refrigerator compressor, 1100 m/sup 2/ of cryopanels, and a 420 MJ superconducting magnet system. Design features, method of operation, thermal protection, and helium recovery operations are discussed in this paper. 2 refs.

22955 **Coatings for fusion reactor environments.** Mattox, D.M. (Sandia Lab, Albuquerque, NM). *Thin Solid Films ;* **63**: No. 2, 213-226(Apr 1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

The internal surfaces of a toroidal magnetically confined fusion reactor control the impurity injection and gas recycling into the fusion plasma. Coating of internal surfaces may provide a desirable and possibly necessary design flexibility for achieving the temperatures, ion densities and containment times necessary for net energy production from fusion reactions. In this paper the reactor environments experienced by various components are reviewed along with possible materials responses. Characteristics of coating-substrate systems that are important to fusion applications are delineated and the present status of coating development for fusion applications is reviewed. 62 refs.

22956 **Deuterium trapping measurements in aluminum and plasma-sprayed aluminum coatings.** Wilson, K.L.; Haggmark, L.G. (Sandia Lab, Livermore, Calif). *Thin Solid Films ;* **63**: No. 2, 283-288(Apr 1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

Bulk and plasma-sprayed aluminum samples were bombarded with 10 keV D/sub 3//sup +/ to a standard fluence of 10/sup 18/ at implant temperatures of 100-400/degree/C. Gas re-emission, thermal desorption and D(/sup 3/He,/varies directly as/)H measurements were conducted. The results indicate that the saturation deuterium trapping level was about 10/sup 16/-10/sup 17/ atoms cm/sup -2/ and was primarily confined to about the first 0.2 /mu/m depth. Trapping of about 10/sup 16/ atoms cm/sup -2/ was still observed after anneals to 530/degree/C. 19 refs.

22957 **Plasma-sprayed coatings for fusion reactor applications.** Mullendore, A.W.; Mattox, D.M.; Whitley, J.B.; Sharp, D.J. (Sandia Lab, Albquerque, NM). *Thin Solid Films ;* **63**: No. 2, 243-249(Apr 1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

A series of plasma-sprayed coatings has been given a preliminary evaluation to assess the potential of this class of materials in fusion reactor applications. TiC, TiB/sub 2/, beryllium and VBe/sub 12/ coatings on copper and stainless steel (SS) were tested for coating adherence, ion erosion resistance and susceptibility to arc

erosion. The coatings, in general, display a good resistance to thermal shock failure. The TiC and TiB/sub 2/ coatings exhibit favorable ion erosion characteristics and the resistance of the coatings to arc erosion was, in general, superior to that of SS. 4 refs.

**22958 Reactively sputtered oxide optical coatings for inertial confinement fusion laser components.** Pawlewicz, W.T.; Busch, R. (Battelle, Pac Northwest Lab, Richland, Wash). *Thin Solid Films ;* **63**: No. 2, 251-256(Apr 1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

Results to date are presented for a study of reactively sputtered oxide optical coatings which are candidate materials for use in the NOVA Terawatt neodymium glass laser under development at Lawrence Livermore Laboratory, Livermore, California. Experimental details are described for the deposition of TiO/sub 2/ on fused silica substrates by r.f. diode sputtering of titanium in a reactive Ar-O/sub 2/ atmosphere. Specific deposition procedures are presented for variation of the phase composition and grain size of the coatings over wide ranges. High laser damage thresholds are reported for TiO/sub 2/, and glassy coatings appear to be more damage resistance than polycrystalline coatings. Phase composition appears to be less important to damage resistance than grain size. Application of the reactive sputtering process to preparation of damage-resistant oxides of In-Sn and tantalum is also described and damage thresholds obtained to date are reported. 4 refs.

**22959 Boron coatings on graphite for fusion reactor applications.** Pierson, H.O.; Mullendore, A.W. (Sandia Lab, Albuquerque, NM). *Thin Solid Films ;* **63**: No. 2, 257-261(Apr 1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

This study is an experimental investigation of boron coatings on graphite and the preliminary determination of some of their physical and nuclear related properties. The boron was obtained by the decomposition of diborane in argon at 500/degree/C and 1 atm. Adhesion to the graphite (POCO AXF-5Q) was good if a slightly roughened surface was provided. The boron was pseudo-amorphous, had high purity with no observable porosity and the fractured surface showed no growth features. It was very hard and had good resistance to hydrogen ion erosion and to arcing. It may, therefore, be a suitable cnadidate for first wall and limiter coatings in toroidal magnetically confined fusion reactors. 10 refs.

**22960 Deuterium and helium ion irradiation effects on $TiB_2$ coatings.** Das, S.K.; Kaminsky, M. (Argonne Natl Lab, Ill). *Thin Solid Films ;* **63**: No. 2, 269-275(Apr 1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

The surface damage and erosion of chemically vapor deposited TiB/sub 2/ coatings and commercial grade titanium, caused by 40, 60 and 120 keV D/sup +/ and /sup 4/He/sup +/ irradiation, have been studied for the as-deposited coatings and for coating surfaces that were mechanically polished prior to irradiation. Scanning electron microscopy analysis of polished TiB/sub 2/ samples irradiated with D/sup +/ and /sup 4/He/sup +/ to a dose of 3.1*10/sup 18/ ions cm/sup -2/ reveals significant surface damage due to blistering and flaking, whereas for identical irradiation conditions the as-deposited TiB/sub 2/ coatings show very little damage. For similar irradiation conditions the titanium metal samples showed blistering for the /sup 4/He/sup +/ irradiation case but no significant surface damage for the D/sup +/ case. Estimates of the erosion yields due to blister exfoliation in polished TiB/sub 2/ samples show an increase with increasing projectile energy for the total dose studied. 9 refs.

**22961 Three phase energy transfer circuit with superconducting energy storage coils.** Fuja, R.E.; Kustom, R.L.; Ehsani, M. (Argonne Natl Lab, Ill). *Conference Record, IAS (Industry Applications Society) Annual Meeting ;* No. 79CH1484-51A, 472-478(1979). (CONF-7910107—).

From IEEE-IAS conference on "electrostatics"; Cleveland, OH, USA (1 Oct 1979).

The efficient transfer of energy between two superconducting coils can be achieved by commutating capacitors with thyristor networks. The inductor-converter bridge (ICB) is one of the circuits which allows controllable, reversible, and efficient transfer of the energy. The ICB circuit allows energy from one coil, in the form of direct current, to be transferred to capacitors to generate multiphase symmetrical voltages. These voltages are rectified to provide a time-averaged value of direct voltage needed to charge the second coil. Large superconducting coil systems requiring reversible and controllable transfer of energy between the coils are likely to have application in future tokamak fusion wer reactors and large particle accelerator systems. The pulsed power loads for the coils of these future systems have the prospect of exceeding 1000 Mw for periods of 1 to 20 s. A companion superconducting energy storage coil and thyristor network provides isolation of these massive pulsed loads from the utility grid.

**22962 High response control of stator watts and vars for large wound rotor induction motor adjustable speed drives.** Mayer, C.B. (GE, Schenectady, NY). *Conference Record, IAS (Industry Applications Society) Annual Meeting ;* No. 79CH1484-51A, 817-823(1979). (CONF-7910107—).

From IEEE-IAS conference on "electrostatics"; Cleveland, OH, USA (1 Oct 1979).

The subject of this paper is the control of a 22 pole, 60 Hz, doubly-fed 15,000 hp wound rotor induction machine. The machine is part of an energy storage and supply system for powering an experimental fusion reactor. High response control of stator watts and vars has been obtained of the cycloconverter controlled, double-range machine with an orthogonal control scheme which linearizes the machine equations and combines both feedforward and feedback error signals. Leading and lagging power factor and positive or negative stator power flow can be smoothly and rapidly controlled over a speed range in excess of /plus or minus/35% of the induction motor synchronous speed. 13 refs.

**22963 Hydrogen retention and release in first-wall coatings for tokamaks.** Doyle, B.L.; Vook, F.L. (Sandia Lab, Albuquerque, NM). *Thin Solid Films ;* **63**: No. 2, 277-281(1979). (CONF-790442—).

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

The hydrogen retention and release of two first-wall coating materials, TiB/sub 2/ and B/sub 4/C, were measured. Hydrogen is released from TiB/sub 2/ at substantially lower temperatures or laser energy fluxes (pulsed pulsed annealing than for B/sub 4/C. Hydrogen also diffuses to a much smaller extent into TiB/sub 2/ than into B/sub 4/C. On the basis of tritium inventory control, TiB/sub 2/ appears to be superior to B/sub 4/C. 13 refs.

**22964 Helios $CO_2$ fusion laser alignment system.** Hanlon, J.; Bausman, M.D.; Caine, M.; Calcote, M.; Carlson, R.L.; Hayden, J.J.; Liberman, I.; Murphy, J.; Parnell, R.; Partridge, R.; Reay, J.; Salazar, G. (Univ of Calif, Los Alamos Sci Lab, NM). *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **179**: 61-66(1979). (CONF-790418—).

From Scanning electron microscopy conference; Washington, DC, USA (16 Apr 1979).

This paper describes the alignment system for the eight-beam CO/sub 2/ laser, Helios, which is now being used in the study of compression and heating of targets as a step toward determining the feasibility of laser-initiated fusion for commercial power generation. The laser system reached design point output of 10 kJ at powers in excess of 20 TW in June 1978. 6 refs.

**22965 Alignment accuracy of the Helios $CO_2$ laser.** Liberman, I.; Benjamin, R.F. (Univ of Calif, Los Alamos Sci Lab, NM). *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **179**: 67-74(1979). (CONF-790418—).

From Scanning electron microscopy conference; Washington, DC, USA (16 Apr 1979).

The accuracy with which beams from the LASL eight-beam CO/sub 2/ laser, Helios, can be centered onto a fusion target has been measured. The average pointing error of 34 /mu/m is adequate for initial high-power experiments. The technique is rapid and

accurately simulates the conditions of actual target experiments. 4 refs.

22966 **Actively mode-locked and Q-switched oscillator system (21 Aug 1980) (Engineering Materials).** (California Univ., Livermore (USA). Lawrence Livermore Lab.). (CAPE—2694).

261 drawings.

This drawing package contains all the circuit diagrams, parts lists and assembly details for most of the electronics that are required to operate the AMQ oscillator. Normally, these controls are assembled to operate a single oscillator, but they can be expanded to drive multiple oscillators. These controls were developed for the oscillator on Argus, and are thus not compatible with the computer type controls on Shiva. These controls have to perform the following functions: (1) generate the necessary timing signals for the lamp current, Q-switch and modulator RF signals, as well as the system to switch out a single pulse from the oscillator output; (2) control the RF signals to the modulator and Q-switch; (3) control the lamp current; (4) amplify the RF signals to the modulator and Q-switch; and (5) generate the high voltage signal to the Pockels cells to switch out a single pulse.

# 99 GENERAL AND MISCELLANEOUS

## 9901 Management

*REFER ALSO TO CITATION(S) 22989*

22967 **(DOE/IG—0008/1) Office of the Inspector General. Annual report.** Wright, J.K. (Department of Energy, Washington, DC (USA). Office of Inspector General). Mar 1981. 60p. NTIS, PC A04/MF A01.

A summary of the progress and problems encountered by the Office of the Inspector General during 1980 is presented. Information on such administrative matters as the IG office organization, staffing, affirmative action, and training is reported. Planning and policy matters and expectations for the future are discussed. Important work done by the audit, inspection, and investigative staffs is summarized. Summaries of significant findings, recommendations, and actions taken in response are included. (MCW)

22968 **Type-insensitive ODE codes based on implicit A-stable formulas.** Shampine, L.F. (Department of Applied Mathematics, University of New South Wales, Sydney, N.S.W. 2033, Australia). *Mathematics of Computation ;* **36**: No. 154, 499-523(Apr 1981).

A special concept of stiffness is appropriate for implict A-stable formulas. It is possible to recognize this kind of stiffness economically and reliably using information readily available during the integration of an ODE. Using this development, a variety of effective ODE solvers could be made insensitive to the type of problem, i.e. the code would automatically recognize and alter automatically its algorithm at any step depending on whether the problem is stiff there.

## 9902 Mathematics And Computers

*REFER ALSO TO CITATION(S) 21607, 21619, 22224, 22265, 22486, 22521, 22534, 22538, 22541, 22590, 22703, 22744, 22745, 22859, 22990*

22969 (CONF-791016—, pp 201-204) **Many facets of large.** Carr, D.B. (Pacific Northwest Lab., Richland, WA). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

The data set is large when the size of the data is the major factor in preventing the convenient and effective analysis of the entire data set. This definition, while less than satisfactory, clearly suggests that large is not simply defined and that a true understanding of large develops after actually analyzing large data sets. This paper characterizes large from four general frameworks. The first general framework deals with the computing problems and characteristics encountered in analyzing large data sets. The second general framework presents the way a statistician might conceptualize large data sets and presents some of the approaches he might propose for dealing with the problems encountered. The third general framework has to do with a new concept of efficiency that is engendered by the analysis of large data sets. The final framework has to do with the new possibilities that go hand in hand with large data sets.

22970 (CONF-791016—, pp 205-208) **Analysis of large data sets project: computer science research areas.** Burnett, B. (Pacific Northwest Lab., Richland, WA). Sep 1980. NTIS, PC A11/MF A01.

From 1979 DOE statistical symposium; Gatlinburg, TN, USA (24 Oct 1979).

The Analysis of Large Data Sets project at Pacific Northwest Laboratory provides the focus for a high degree of interaction among the statisticians and computer scientists involved. This paper addresses some of the areas of computer science research and software development required to create and support a large data set analysis capability. The data analyst must be able to effectively initiate, monitor, and control the data analysis process via a convenient, easily learned method of communication with the computational resource. An obvious user interface is being developed to meet this need. A self-describing data file structure and associated data management modules will provide a common data interface among diverse software packages. In addition, the self-contained data descriptions and compact data representations allow complete characterization of the data items and provide for economy of data storage and rapid data access. Advanced statistical graphics displays and interactive graphical input techniques will provide the data analyst with a powerful tool with which to visualize complex data relationships. Areas of cooperation and interaction with other research laboratories and universities are also discussed.

22971 **(CONF-810406—5) Identification of multivariate linear systems.** Griffith, J.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 6p. NTIS, PC A02/MF A01.

From 27. international instrumentation symposium; Indianapolis, IN, USA (27 Apr 1981).

This paper considers the problem of modeling multivariate linear systems where noisy output measurements are the only available data. The techniques presented are valid for a class of canonical forms. Results from several simulations demonstrate the capability for structure and parameter estimation.

22972 **(CONF-810406—7) Methodologies for calculating measurement uncertainties.** Lassahn, G.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 5p. NTIS, PC A02/MF A01.

From 27. international instrumentation symposium; Indianapolis, IN, USA (27 Apr 1981).

An improved general procedure for estimating and reporting measurement uncertainty is outlined and is compared with other procedures. The primary advantage of the improved procedure is that the uncertainty is defined concisely, consistently, and objectively.

22973 **(EGG-EA—5455) User's guide to ANYOLS: a flexible stepwise regression program.** Atwood, C.L. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1981. Contract AC07-76ID01570. 71p. NTIS, PC A04/MF A01.

ANYOLS is a stepwise regression program. It fits data using ordinary or weighted least squares. It selects the variables to put into the model in a stepwise way, based on F, $s^2$, MSE (based on C/sub p/), PRESS, or a user-written subroutine. The user can define forcing priorities to influence the order of entering variables. Instead of stepwise selection, the program can also try all possible combinations of any desired subset of the variables. Automatic output for the final model in a stepwise search includes plots of the residuals, studentized residuals, and leverages; if the model is not too large, the output also includes partial regression and partial leverage plots. A data set may be re-used so that several selection criteria can be tried. Flexibility is increased by allowing the substitution of user-written FORTRAN subroutines for several default subroutines. The program is written in CDC FORTRAN 4.

**22974 (LA-UR—81-1082) Experience with a multiprocessor based on eight FPS 120B array processors.** Bucher, I.Y.; Frederickson, P.O.; Moore, J.W. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 8p. (CONF-810424—3). NTIS, PC A02/MF A01.

From ARRAY user's annual conference; St Louis, MO, USA (26 Apr 1981).

The rate of increase in the speed of monoprocessors is no longer keeping pace with the needs of the laboratory; accordingly, the use of parallel processors in large scientific computations is being investigated. As an initial experiment, a particle-in-cell plasma simulation was adapted to run on a star graph architecture consisting of a UNIVAC 1110 as hub, and up to eight Floating Point Systems AP120B array processors at the other vertices. Subdivision of tasks among processors and measured results are discussed.

**22975 (LA-UR—81-1192) PLOT2K: a graphics interface to System 2000.** Creel, L.R. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810476—1). NTIS, PC A02/MF A01.

From VIM 34 conference; Chicago, IL, USA (Apr 1981).

PLOT2K is a versatile tool for generating graphs from a System 2000 data base. Its chief virtue is the ease with which it can be used, modified, and developed. This makes the graphics plot accessible to a wide range of users and allows it to be altered to suit a wide range of needs.

**22976 (SAND—81-0691C) SNLA terminal switching network.** Vahle, M.O.; Tolendino, L.F.; Thompson, M.D. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 6p. (CONF-810623—2). NTIS, PC A02/MF A01.

From 24. midwest symposium on circuits and systems; Albuquerque, NM, USA (29 Jun 1981).

The rapidly growing number of interactive terminals at Sandia National Laboratories must compete for a limited number of computer ports. In addition, interactive computer users require access to several host systems. To meet these needs a terminal switching network was designed which utulizes circuit switching techniques to provide port contention and multiple host access.

**22977 (SAND—81-0994) Local design specifications for the CCN security controller (SC).** Bennett, W.P.; Jones, L.C. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01.

This is a description of the preliminary local design specifications of the Central Computing Network Security Controller. The external interface to the Central Computing Network is not described, but the functions and services to be provided are included as justification for the local design.

**22978 (UCID—18649) DOE workshop on design automation and computer-aided design: abstracts.** (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1980. Contract W-7405-ENG-48. 44p. (CONF-8006166—). NTIS, PC A03/MF A01.

From Workshop on design automation and computer aided design; Livermore, CA, USA (10 Jun 1980).

The aims and objectives in organizing this two-day workshop were to discuss the needs, activities, and plans for design automation (DA) and computer-aided design (CAD) of engineering systems within the DOE laboratories and major DOE contractors. The intent has been to provide a forum to exchange information and ideas and to foster DA/CAD communications among DOE laboratories and contractors. It is hoped that by sharing experiences and future plans the DOE community will be better able to identify problem areas so that research and development in DA and CAD can be better organized, supported, and made available. Abstracts of 30 papers given at the workshop are presented.

**22979 (UCID—30183) Linear system analysis program: programmer's manual.** Weis, T.P. (Lawrence Livermore National Lab., CA (USA)). 15 Feb 1981. Contract W-7405-ENG-48. 24p. NTIS, PC A02/MF A01.

The computer program Linear Systems Analysis Program (LSAP) is an interactive program with graphic capability that can be used for the analysis and design of linear control systems. Nearly all classical design tools are available, including manipulation of transfer functions and generation of root locus, time response, and frequency response plots. This manual discusses the structure of the program. Included are explanations of implementation details of the underlying data structure.

**22980 (UCRL—15346) Comparison of programming languages: Ada, Praxis, Pascal, C.** Evans, A. Jr. (Bolt, Beranek and Newman, Inc., Cambridge, MA (USA)). Apr 1981. Contract W-7405-ENG-48. 65p. NTIS, PC A04/MF A01.

Although the programmer dealing with systems programming now has a fairly rich choice of programming languages, there is sometimes little guidance other than hearsay about how to choose among them. In this document four high order languages (HOLs) are examined and their features compared, evaluating the ability of each to meet the goals of systems programming. A major purpose of the discussion is to introduce Praxis, a new language, and to compare it with existing languages.

**22981 (UCRL—83791(Rev.1)) Verification of timing constraints on large digital systems.** McWilliams, T.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Apr 1980. Contract W-7405-ENG-48. 10p. (CONF-800622—2(Rev.1)). NTIS, PC A02/MF A01.

From 17. design automation conference; Minneapolis, MN, USA (23 Jun 1980).

A new approach to the verification of the timing constraints on large digital systems has been developed. The associated algorithm is computationally very efficient, and provides early and continuous feedback about the timing aspects of synchronous sequential circuits as they are designed. It also provides means for conveniently verifying the design in sections, permitting the section-by-section timing verification of designs which are too large to examine as a unit on existing computer systems. A system using this algorithm has been implemented, and has been used to verify the timing constraints on the design of the S-1 Mark IIA processor.

**22982 (UCRL—84964) Computer-aided design drafting/manufacturing (CADD/M) facility preparation.** Norton, F.J. (Lawrence Livermore National Lab., CA (USA)). 23 Sep 1980. Contract W-7405-ENG-48. 16p. (CONF-8009151—4). NTIS, PC A02/MF A01.

From 6. annual ADUA meeting; Denver, CO, USA (30 Sep 1980).

Computer-Aided Design, Drafting and Manufacturing (CADD/M) equipment requires careful facilities preparation before installation takes place. This paper presents what a company should consider to ensure a proper installation. This includes consideration of working conditions. To get the most out of the system, the operators must be provided with a relaxed, comfortable environment, free from noise and other distractions. Such things as temperature requirements, lighting, power, security and fire protection are discussed. Also, future expansion needs are considered so that major construction will not be required for future years. Advanced planning in these areas is needed to ensure successful implementation of a CADD/M system. This will lead to considerable cost savings, and in the long run, improve the scheduling for an entire project, from initial design to final production. This careful preparation will minimize unplanned events and problem areas. These are ambitious goals but easily realized if a logical and rational plan is adopted in the same manner as that used in a typical development program.

**22983 (UCRL—84965) Selecting and implementing an interactive Computer Aided Design Drafting/Manufacturing (CADD/M) system.** Norton, F.J. (Lawrence Livermore National Lab., CA (USA)). 23 Sep 1980. Contract W-7405-ENG-48. 54p. (CONF-8009151—3). NTIS, PC A04/MF A01.

From 6. annual ADUA meeting; Denver, CO, USA (30 Sep 1980).

Success with Interactive Computer-Aided Design Drafting/Manufacturing (CADD/M) depends upon management, users, and the system itself. If you are in a design and drafting environment, the thought of acquiring a CADD/M system will probably occur to you sometime in the very near future - if it hasn't already. Con-

vincing yourself and your management of the benefits of such systems is but the first step. Evaluating and selecting one particular type of CADD/M system can turn out to be a complicated undertaking - not to mention somewhat frustrating. Procedures for selecting and successfully implementing a CADD/M system are outlined. INITIAL PREPARATION examines the techniques used to evaluate CADD/M systems including formation of an evaluation team, and application analysis. GRAPHICS EVALUATION describes the methods that can be used to test a CADD/M system, including benchmark drawings and specifications, human engineering considerations, and other evaluation criteria and general system configurations are also discussed. COMPUTER SYSTEM EVALUATION examines other factors in systems selection: programming, communications, documentation, and service. SYSTEM STARTUP addresses site preparation, people preparation, system acceptance, and operator, designer/drafter selection. Finally, operator, designer/drafter TRAINING and SYSTEM MANAGEMENT are discussed. This systematic approach wil help those contemplating the acquisition of CADD/M systems for their activities and will help minimize unplanned events and problem areas.Advanced planning in these areas is needed to ensure successful implementation of a CADD/M system. This in turn will lead to considerable cost savings and schedule improvements for an entire project, from initial design to final production. These are ambitious goals but easily realized if a logical and rational plan is adopted in the same manner as that used in a typical development program.

22984 **(UCRL—84966) Cost justification for an interactive Computer-Aided Design Drafting/Manufacturing system.** Norton, F.J. (Lawrence Livermore National Lab., CA (USA)). 23 Sep 1980. Contract W-7405-ENG-48. 23p. (CONF-8009151—2). NTIS, PC A02/MF A01.

From 6. annual ADUA meeting; Denver, CO, USA (30 Sep 1980).

Many factors influence the capital investment decision. System costs and benefits are weighed by methods of financial analysis to determine the advisability of an investment. Capital, expense, and benefits as related to Interactive Computer-Aided Design Drafting/Manufacturing (CADD/M) Systems are discussed and model calculations are included. An example is treated by the simple payback method and the more sophisticated methods of Net Present Value (NPV) and Internal Rate of Return (IRR). The NPV and IRR approaches include in the calculation the time value of money and provide a sounder foundation on which to base the purchase decision. It is hoped that an understanding of these techniques by technical personnel will make an optimum system purchase more likely.

22985 **(UCRL—85310) Multitest, DVM-based data acquisition system on an LSI-11/23, running under RSX-11M.** Liston, D.H.; McDonald, W.M.; Koopman, S.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Apr 1981. Contract W-7405-ENG-48. 13p. (CONF-810546—2). NTIS, PC A02/MF A01.

From 1981 spring DECUS U.S. symposium; Miami Beach, FL, USA (18 May 1981).

A digital voltmeter (DVM) based data acquisition system that allows multiple simultaneous tests to be conducted concurrently was designed. Using an LSI-11/23 and the RSX-11M operating system, the system acquires, displays, and stores data from strain gages, load cells, etc. Post-test data can also be routed via DECNET to another node of the network for archiving or analysis. To ensure that the system would meet the needs of the users, several design documents were created that were agreed upon by the designers and users before any software was written. This design strategy had several advantages, described in this paper along with the performance problems, hardware selection, and software design.

22986 **Finite element method with nonuniform mesh sizes for unbounded domains.** Goldstein, C.I. (Applied Mathematics Department, Brookhaven National Laboratory, Upton, New York 11973). DE-AC02-76H00016. *Mathematics of Computation ;* **36**: No. 154, 387-404(Apr 1981).

The finite element method with nonuniform mesh sizes is employed to approximately solve elliptic boundary value problems in unbounded domains. Consider the following model problem: -Du = f in W/sup C/, u = g on partialW, partialu/partialr+1/r u = o(1/r) as r = x $\rightarrow\infty$, where W/sup C/ is the complement in $R^3$ (three-dimensional Eucidean space) of a bounded set W with smooth boundary partialW, f and g are smooth functions, and f has bounded support. This problem is approximately solved by introducing an artifical bound G/sub R/ near infinity, e.g. a sphere of sufficiently large radius R. The intersection of this sphere with W/sup C/ is denoted by W/sub R//sup C/ and the given problem is replaced by -Du/sub R/ = f in W/sup C//sub R/, u/sub R/ = g on partialW, partialu/sub R//partialr+1/r u/sub R/ = 0 on G/sub R/. This problem is then solved approximately by the finite element method, resulting in an approximate solution u /sub R//sup h/ for each h>0. In order to obtain a reasonably small error for u-u /sub R//sup h/ = (u-u/sub R/)+(u/sub R/-u /sub R//sup h/), it is necessary to make R large. This necessitates the solution of a large number of linear equations, so that this method is often not very good when a uniform mesh size h is employed. It is shown that a nonuniform mesh may be introduced in such a way that optimal error estimates hold and the number of equations is bounded by $Ch^{-3}$ with C independent of h and R.

22987 **High-order accurate numerical algorithm for three-dimensional transport prediction.** Pepper, D.W. (Savannah River Lab., Aiken, SC); Baker, A.J. Contract AC09-76SR00001. *Computers and Fluids ;* **8**: No. 4-A, 371-390(1980).

The numerical solution of the three-dimensional pollutant transport equation is obtained with the method of fractional steps; advection is solved by the method of moments and diffusion by cubic splines. Topography and variable mesh spacing are accounted for with coordinate transformations. First estimate wind fields are obtained by interpolation to grid points surrounding specific data locations. Numerical results agree with results obtained from analytical Gaussian plume relations for ideal conditions. The numerical model is used to simulate the transport of tritium released from the Savannah River Plant on 2 May 1974. Predicted ground level air concentration 56 km from the release point is within 38% of the experimentally measured value.

22988 **Method for solving a specific energy system on a minicomputer.** Kalita, J.K.; Goetschel, D.V. (Argonne Natl Lab, Ill). pp 855-859 of Instrument Society of America, Pittsburgh modeling and simulation conference. Pittsburgh, PA; ISA (Apr 1979).

From Instrument Society of America, Pittsburgh modeling and simulation conference; Pittsburgh, PA, USA (25 Apr 1979).

Recently, efforts have been concentrated on the use of minicomputers to optimize the performance of energy systems. A description is presented of a specific energy subsystem and its mathematical formulation. The formulation by design required a nonlinear programming algorithm which had to be modified in order to be used on a minicomputer. The results due to this approach justify further research in this area. 4 refs.

## 9903 Information Handling

*REFER ALSO TO CITATION(S) 22225, 22540, 22671*

22989 **(DOE/EIA/10313—T4) Final summary report on an analysis of selected energy information administration publications.** (MAXIMA Corp., Bethesda, MD (USA)). 1981. Contract AC01-80EI10313. 8p. NTIS, PC A02/MF A01.

This document summarizes work designed to provide the EIA Office of Energy Data Operations with a comprehensive analysis of selected EIA publications. The analysis includes recommendations for the replacement, elimination, or integration of forms, data series, data systems, data bases, and publications. It also suggests improvements in the content, format, and structure of an integrated publications series for selected major energy areas. Tabular and graphical tables documenting interrelationships between and among data elements contained in publications were developed and prepared. A description of the work performed to date is given and includes a summary of findings on: Electric Power Monthly (EPM); The Quarterly Coal Review (QCR); Review of the Proposed Quarterly Coal Review; Review of the Coal and Electric

Sections in the Monthly Energy Review. Recommendations are summarized. (MCW)

22990 **(LBL—12350) Modelling summary data.** Johnson, R.R. (Lawrence Berkeley Lab., CA (USA)). 1981. Contract W-7405-ENG-48. 18p. (CONF-810467—2). NTIS, PC A02/MF A01.

From SIGMODE international conference on management of data; Ann Arbor, MI, USA (29 Apr 1981).

Several problems in specifying aggregate functions in relational systems are investigated. A solution is proposed to these problems in the form of an extension of the relational data model. In particular the concept of summary data is introduced. The query language STRAND is presented in order to describe retrieval operations on the extended model. STRAND allows a user to formulate queries involving aggregate functions without conceptualizing the query in terms of aggregation. Two example applications, proposal tracking and socio-demographic data bases, are used to illustrate the concepts of the extended model.

# CORPORATE INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

## A

**Advanced Energy Concepts, San Diego, CA (USA)**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)

**Aerospace Research Corp., Roanoke, VA (USA)**
Redesign of turbine-pump impeller and diffuser using hydrodynamic design techniques. Final report, 6:22239 (DOE/CS/40183—T1)

**AIA Research Corp., Washington, DC (USA)**
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes, 6:22194 (DOE/TIC—11453)
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes, 6:22195 (DOE/TIC—11454)
Phase-two report for the development of Energy-Performance Standards for new buildings. Final report, 6:22198 (DOE/TIC—11457)
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: single-family dwellings, 6:22196 (DOE/TIC—11455)

**Airco Temescal Div., Berkeley, CA (USA)**
Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils, 6:21999 (DOE/ET/12292—T1)

**Air Products and Chemicals, Inc., Allentown, PA (USA)**
Gas/slurry flow in coal-liquefaction processes (fluid dynamics in 3-phase flow columns). Quarterly technical progress report, 1 July 1980-30 September 1980, 6:21498 (DOE/ET/14801—12)

**Air Products and Chemicals, Inc., Trexlertown, PA (USA)**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, December 1, 1979-February 29, 1980, 6:21500 (DOE/ET/14806—T3)

**Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.**
Production of aluminum-silicon alloy and ferrosilicon and commercial purity aluminum by the direct reduction process. First interim technical report, Phase D, January 1-March 31, 1981, 6:22266 (CONS—5089-15)
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, July 1-September 30, 1979, 6:21558 (DOE/CS/40037—T1)
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, October 1-December 31, 1979, 6:21559 (DOE/CS/40037—T2)

**Argonne National Lab., IL (USA)**
Air quality analysis of Phase I of the proposed oil backout legislation, 6:21540 (ANL/EES-TM—130)
Analysis of flow, gas-particle radiation, and particulate deposition in radiant boilers, 6:22143 (ANL/MHD—81-5)
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
Construction-employment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities, 6:22100 (ANL/CNSV—19)
Fast reactor safety program. Progress report, January-March 1980, 6:22066 (ANL/TMC—80-3)
In pursuit of clean air: a data book of problems and strategies at the state level. Supplement, 6:22535 (ANL/EES-TM—129)
MHD heat and seed recovery technology project. Ninth quarterly report, January-March 1980, 6:22142 (ANL/MHD—80-8)
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
Numerical simulation for two-phase jet problem, 6:22080 (LA-UR—81-317)
Studies on a high-grade polarized lithium-6 target, 6:22506 (ANL-Trans—1195)
Two-phase velocity and density in finite pipes by intrusive and nonintrusive instrumentation, 6:22074 (EGG-M—00881)
Workshop on foundations of the relativistic theory of atomic structure, 6:22748 (ANL—80-126)

**Arizona Solar Energy Research Commission, Phoenix (USA)**
Evaluation of geothermal energy in Arizona. Arizona geothermal planning/commercialization team. Quarterly topical progress report, July 1-September 30, 1980, 6:21955 (DOE/RA/50076—T3)

**Arizona Univ., Tucson (USA)**
Theoretical studies of plasma turbulence and hydrodynamic instability in fusion targets, 6:22905 (DOE/DP/40003—T1)

**Arkansas Power and Light Co., Little Rock (USA)**
Evaluation and demonstration of methods for improved nuclear-fuel utilization. First semi-annual progress report, inception to June 30, 1980, 6:22046 (DOE/ET/34013—T1)

**Arkansas Univ., Fayetteville (USA). Dept. of Physics**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)

**Aspen Inst. for Humanistic Studies, Boulder, CO (USA)**
Mechanism for the effects of variable solar activity on the weather. Final report, 6:22738 (DOE/ER/04634—1)

**Austin Research Associates, Inc., TX (USA)**
Design study for a high-current, steady-state auto-resonant accelerator. Addendum to final report, July 14, 1979-November 14, 1979, 6:22484 (DOE/ER/05911—T1)

**Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.**
April 1981 environmental data for sites in the National Solar Data Network, 6:21741 (SOLAR/0010—81/04)
National solar data program performance results, Volume II, 6:21866 (SOLAR/0005—81/80)
Saddle Hill Trust Lot 73, Medway, Massachusetts: solar energy system performance evaluation, January 1980-December 1980, 6:21875 (SOLAR/1039—81/14)
Solar energy system performance evaluation, October 1979-April 1980: Bond Construction, Gladstone, Missouri, 6:21876 (SOLAR/1050—81/14)

## B

**Battelle Columbus Labs., OH (USA)**
Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report, 6:21497 (DOE/ET/13537—T3)
Logistics characterization for regional spent fuel repositories concept, 6:21677 (ONWI—124)
Technical progress report for the quarter 1 April-30 June 1980, 6:21675 (ONWI—9(3)(1980))
**Battelle Human Affairs Research Center, Seattle, WA (USA)**
Analysis of institutional issues in the implementation of Federal energy-performance standards for new buildings, 6:22212 (PNL—3312)
**Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)**
Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density, 6:22630 (CONF-8005164—1)
**Battelle Memorial Inst., Columbus, OH (USA)**
NWTS program criteria for mined geologic disposal of nuclear waste: program objectives, functional requirements, and system performance criteria, 6:21665 (DOE/NWTS—33(1))
**Battelle Pacific Northwest Labs., Richland, WA (USA)**
Bioindicators of the health of arctic foxes, 6:22660 (PNL-SA—9197)
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
Commercial US nuclear reactors and waste: the status, December 1980, 6:21682 (PNL-SA—9231)
Comparison of chemical and mutagenic properties of a coal liquid and a shale oil, 6:21516 (PNL-SA—8812)
Design and performance of atomizing nozzles for spray calcination of high-level wastes, 6:21680 (PNL—3702)
Economics of power plant district and process heating in Richland, Washington, 6:22255 (PNL—3719)
Effective summary evaluators for deep nuclear waste repositories: geohydrologic response function., 6:21681 (PNL-SA—9092)
Geostatistical modeling of pore velocity, 6:22725 (PNL-SA—9096)
Historical perspectives on limits for internal emitters, 6:22861 (PNL-SA—9333)
Photovoltaics, 6:21772 (PNL-SA—9464)
Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)
Use of Geohydrologic Response Functions in the assessment of deep nuclear waste repositories: assessment of effectiveness of geologic isolation systems, 6:21692 (PNL—3817)
Wind measurement systems and wind tunnel evaluation of selected instruments, 6:21978 (PNL—3435)
Wire rope research and logging, 6:22425 (PNL-SA—8797)
**Bechtel National, Inc., San Francisco, CA (USA)**
Preliminary heat pipe testing program. Final technical report, 6:21838 (DOE/SF/10756—1)
**Bendix Corp., Kansas City, MO (USA)**
Effect of workpiece edge angle on radius produced by vibratory finishing, 6:22417 (BDX—613-2620)
**Bendix Field Engineering Corp., Grand Junction, CO (USA)**
Some concepts of favorability for world-class-type uranium deposits in the northeastern United States, 6:21622 (GJBX—80(81))
**Bern Univ. (Switzerland)**
Internal spin structure of the proton from high energy polarized e-p scattering, 6:22825 (SLAC-PUB—2674)
**Bettis Atomic Power Lab., West Mifflin, PA (USA)**
Summary of the hydraulic evaluation of LWBR (LWBR development program), 6:22042 (WAPD-TM—1386)
Summary of the thermal evaluation of LWBR (LWBR Development Program), 6:22041 (WAPD-TM—1385)
**Biphase Energy Systems, Santa Monica, CA (USA)**
Generation of useful energy from process fluids using the Biphase turbine. Final report, 6:22242 (DOE/ET/15350—1)
**Boeing Co., Seattle, WA (USA)**
Solar project description for Helio-Thermics, Inc., Lot 6 single family residence: Greenville, South Carolina, 6:21874 (SOLAR/1025—81/50)
Solar project description for Matt Cannon multi-unit apartment, Gainesville, Florida, 6:21935 (SOLAR/1044—80/50)
**Bolt, Beranek and Newman, Inc., Cambridge, MA (USA)**
Comparison of programming languages: Ada, Praxis, Pascal, C, 6:22980 (UCRL—15346)
**Bonneville Power Administration, Portland, OR (USA)**
Proposed fiscal year 1981 program. Final environmental impact statement, 6:22010 (DOE/EIS—0060)
**Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)**
Preliminary market analysis for customer side of the meter thermal-energy storage, 6:22193 (DOE/ET/26716—T1)
**Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry**
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
**Brigham Young Univ., Provo, UT (USA). Thermochemical Inst.**
Separation of alkali, alkaline earth and rare earth cations by liquid membranes containing macrocyclic carriers. Third progress report, September 1, 1980-April 1, 1981, 6:22326 (DOE/ER/05016—3)
**Brookhaven National Lab., Upton, NY (USA)**
Carbon and carbon-14 in lunar soil 14163, 6:22737 (BNL—29527)
Compilation of requests for nuclear data, 6:22843 (DOE/NDC—22/U)
Ground coupling and single-blow thermal storage in a double-envelope house, 6:22169 (BNL—29480)
Highlights of high energy pp, anti pp and $e^+e^-$ interactions, 6:22817 (BNL—29465)
Is Yang-Mills equation a totally integrable system. Lecture III, 6:22834 (BNL—29546)
New aspects in the evaluation of thermal neutron cross sections, 6:22858 (BNL-NCS—29035)
Phenomenology of quark mixing and the Kobayashi-Maskawa model, 6:22822 (BNL—29468)
RELWAY: a process data highway system optimized for accelerators, 6:22481 (BNL—29243)
Solar neutrino experiments and neutrino oscillations, 6:22736 (BNL—29440)
**Brown Associates, Silver Spring, MD (USA)**
Budget percentiles for baseline and redesigned: theaters, stores, shopping centers, storage, hi-rise apartments; low rise apartments, 6:22202 (DOE/TIC—11463)
Budget percentiles for baseline and redesigned all commercial building types assuming no cooling, 6:22201 (DOE/TIC—11462)
Budget percentiles for baseline and redesigned commercial type buildings based on resource utilization factors (RUF) for cities with try weather tapes, 6:22200 (DOE/TIC—11461)
Errata, nursing homes. Budget percentiles for baseline and redesigned commercial type buildings: cities with try weather tapes; based on resource utilization factors (RUF); based on price weighting factors (PWF), 6:22203 (DOE/TIC—11464)
Sampling variability for redesign buildings, 6:22199 (DOE/TIC—11460)
**Brown Univ., Providence, RI (USA)**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Bureau of Radiological Health, Rockville, MD (USA)**
CSU-FDA Collaborative Radiological Health Laboratory annual report 1979, 6:22674 (FDA—81-8042)
**Butler Mfg. Co., Grandview, MO (USA). Research Center**
Test building instrumentation cooperative agreement: heating/daylighting prototype development. Phase II. Passive and hybrid solar manufactured building project. Project status report No. 2, April 16, 1980-March 16, 1981, 6:21850 (DOE/CS/30367—T1)
**Butler Mfg. Co., Kansas City, MO (USA)**
Wall collector design analysis: project status report No. 2. Hing/daylighting prototype development, Phase I, 6:21849 (DOE/CS/30367—4)

## C

**California Energy Commission, Sacramento (USA)**
Diffusion of solar energy technologies in the new-construction market: a survey of new solar-home and onventional-home buyers, 6:21853 (DOE/EIA/10189—T2)
High rise buildings, 6:22211 (P—400-80-036)
**California Univ., Berkeley (USA)**
Nuclear materials progress reports for 1980, 6:22264 (LBL—12548)

**California Univ., Berkeley (USA). Dept. of Physics**
Measurement of pair interactions in neodymium ethyl sulfate, 6:22774 (DOE/EV/72005—T2)
**California Univ., Berkeley (USA). Lawrence Berkeley Lab.**
Design of focussing and guide structures for charged particle beams using rare earth cobalt permanent magnets, 6:22492 (LBL—12552)
Retort abandonment: issues and research needs, 6:21617 (LBL—11197)
Wastewater treatment in the oil-shale industry, 6:21615 (LBL—11214)
**California Univ., Irvine (USA). Dept. of Mechanical Engineering**
Effect of solid particles on the turbulent flow of a round gaseous jet: a mathematical and experimental study. Quarterly technical progress report, January 1-April 30, 1981, 6:22441 (DOE/PC/30303—T2)
**California Univ., Livermore (USA). Lawrence Livermore Lab.**
Actively mode-locked and Q-switched oscillator system (21 Aug 1980) (Engineering Materials), 6:22966 (CAPE—2694)
Charge sensitive preamplifier (12 Mar 1981) (Engineering Materials), 6:22509 (CAPE—2690)
Development of advanced technologies for photochemical tritium recovery. Quarterly progress report, January 1, 1980-March 31, 1980, 6:22394 (UCID—18509-80-1)
DOE workshop on design automation and computer-aided design: abstracts, 6:22978 (UCID—18649)
Effect of propagation of coherent pulses on multiple-photon excitation, 6:22789 (UCRL—83764)
Energy flow in high speed perforation and cutting, 6:22432 (UCRL—85016)
JPLAXD: a finite-element program for static plane and axisymmetric analysis of structures in jointed rocks, 6:22732 (UCID—19047)
Multitest, DVM-based data acquisition system on an LSI-11/23, running under RSX-11M, 6:22985 (UCRL—85310)
Optimizing the heat pipe for operation in a magnetic field when liquid-metal working fluids are used, 6:22428 (UCID—19049)
Overview of the ETA/ATA pulse power, 6:22505 (UCRL—83993)
Safety of isotropic flywheels, 6:22087 (UCRL—84347)
Size distribution of LLNL coarse fill, 6:22463 (UCID—18286)
Tandem-mirror program: status and projection, 6:22919 (UCID—18983)
Verification of timing constraints on large digital systems, 6:22981 (UCRL—83791(Rev.1))
**California Univ., Livermore (USA). Lawrence Livermore National Lab.**
Radiochemical data collected on events from which radioactivity escaped beyond the borders of the Nevada test range complex, 6:22529 (UCRL—52934)
**California Univ., San Francisco (USA). School of Medicine**
Bilogical effects of ionizing radiation: epidemiological surveys and laboratory animal experiments. Implications for risk evaluation and decision processes, 6:22694 (LBL—12555)
**Carrier Corp., Syracuse, NY (USA). Energy Systems Div.**
Proprties of the Carrol system and a machine design for solar-powered, air-cooled, absorption space cooling. Phase I and Phase II. Final report, September 1977-March 1979, 6:21851 (DOE/CS/31587—T2)
**Catalytica Associates, Inc., Santa Clara, CA (USA)**
Critical evaluation of fuel-processing technologies for fuel cells. Quarterly report, December 1, 1980-February 28, 1981, 6:22160 (DOE/ET/17103—2)
**Centec Corp., Reston, VA (USA)**
Energy conservation in ethanol production from renewable resources and non-petroleum energy sources, 6:21732 (DOE/CS/40352—T2)
**Center for the Environment and Man, Inc., Hartford, CT (USA)**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Centrum Konstrukcyjno-Technologiczne Maszyn Gorniczych, Gliwice (Poland)**
Coal gettability studies: methods of evaluation and verification of coal deposited in seams, 6:21552 (DOE/TIC—1016824)
Coal gettability testing: the evaluation methods and coal gettability checking in strata, 6:21555 (DOE/TIC—1015202)
Investigation of coal preparation processes in the circulating stream of water subjected to pulsation, 6:21557 (DOE/TIC—1018563)
**CER Corp., Las Vegas, NV (USA)**
Western Gas Sands Project. Status report, October-November-December 1980, 6:21602 (DOE/BC/10003—18)
**Chevron Research Co., Richmond, CA (USA)**
Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, January-March 1981, 6:21493 (DOE/ET/10532—T1)
**Chicago Univ., IL (USA)**
Use of lymphoblastoid cells for the estimation of environmental insults to DNA. Comprehensive report of the overall activities of the contract during the past three years. Progress report, August 1, 1978-June 31, 1981, 6:22704 (DOE/EV/02040—T1)
**City Coll., New York (USA). Dept. of Physics**
Critical conditions for the growth of SiC, $Si_3N_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981, 6:22295 (DOE/ER/10438—T1)
**City Water, Light and Power, Springfield, IL (USA)**
Bridgeview Park facility solar retrofit, 6:21858 (DOE/R5/10216—T1)
**Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering**
Enthalpy measurement of coal-derived liquids. Final technical progress report, 6:21496 (DOE/ET/13395—T1)
**Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.**
Direct contact liquid-liquid heat exchanger for solar-heated and -cooled buildings. Final report, January 1, 1979-May 30, 1980, 6:21852 (DOE/CS/32867—T1)
**Colorado Univ., Boulder (USA). Dept. of Chemical Engineering**
Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems, 6:22446 (UCRL—85366)
Solution of the time-dependent incompressible Navier-Stokes equations via a penalty Galerkin finite element method, 6:22445 (UCRL—85354)
**Columbia Univ., New York (USA). Dept. of Physics**
Theoretical high energy physics. Progress report, May 1, 1980-April 30, 1981, 6:22835 (DOE/ER/02271—T2)
**Combustion Engineering, Inc., Windsor, CT (USA)**
Evaluation and demonstration of methods for improved nuclear-fuel utilization. First semi-annual progress report, inception to June 30, 1980, 6:22046 (DOE/ET/34013—T1)
Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)
**Combustion Power Co., Inc., Menlo Park, CA (USA)**
Granular bed filter development program, Phase II. Quarterly report, June-August 1980, 6:21997 (DOE/ET/10373—T6)
**Concepts Development, Inc., Albuquerque, NM (USA)**
Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)
**Connecticut State Government, Hartford (USA)**
State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980, 6:21586 (DOE/EIA/10221—T2)
**Conoco, Inc., Stamford, CT (USA)**
Demonstration plant process design. Phase I. The Pipeline Gas Demonstration Plant. Volume 1. Executive summary., 6:21535 (DOE/ET/13060—T1)
Pipeline Gas Demonstration Plant. Phase I. Annual technical progress report, July 1, 1979-June 30, 1980, 6:21495 (DOE/ET/13060—T2)
**Consiglio Nazionale delle Richerche (Italy). Gruppo di Macchine Elettriche**
Symposium on power and measurement transformers, 6:22009 (CONF-7909201—)
**Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies**
Generation and focusing of pulsed intense ion beams. Final progress report, April 1, 1979-September 30, 1979, 6:22909 (DOE/DP/40012—T1)
**Curtiss-Wright Corp., Wood-Ridge, NJ (USA). Power Systems Div.**
High-temperature-turbine technology program. Phase II. Technology test and support studies. Technical progress report, April 1, 1979-June 30, 1979, 6:21996 (DOE/ET/10348—T2)

## D

**Dane County Regional Planning Commission, Madison, WI (USA)**
Energy conservation manual: a guide for regional planning commission assistance to small municipalities, 6:22253 (DOE/TIC—1022897)

**Davis Alternative Technology Associates, CA (USA)**
Suncatcher monitoring project. Semi-annual technical report, July-December 1980, 6:21846 (DOE/CS/30169—6)

**Delaware Univ., Newark (USA). Dept. of Chemical Engineering**
Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980, 6:21494 (DOE/ET/11429—T1)

**Delaware Univ., Newark (USA). Inst. of Energy Conversion**
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, March 1-June 1, 1979, 6:21782 (SERI/PR—8063-1-T1)
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, December 1, 1978-March 1, 1979, 6:21783 (SERI/PR—8063-1-T3)
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, September 1-December 1, 1978, 6:21784 (SERI/PR—8063-1-T4)
Cadmium sulfide-copper sulfide heterojunction cell research. Annual report, September 1, 1979-August 31, 1980, 6:21785 (SERI/PR—8309-1-T4)
Cadmium sulfide-copper sulfide heterojunction cell research. Final report, September 1, 1978-August 31, 1979, 6:21794 (SERI/TR—8063-1-T2)
$Zn_3P_2$ as an improved semiconductor for photovoltaic solar cells. Eighth quarterly report, June 1-August 31, 1980, 6:21792 (SERI/PR—80062-1-T1)

**Department of Commerce, Boulder, CO (USA). Inst. for Telecommunication Sciences**
Examination of some hypothetical SPS rectenna sites within the contiguous United States of America. Part I. Precipitation effects on hypothetical SPS sites in the USA. Part II. Point-to-point microwave and service mode communications systems near four hypothetical SPS rectenna sites in the continental United States, 6:21812 (DOE/ER/10160—T4)
SPS susceptible-system cost factors investment summary and mitigation-cost-increment estimates, 6:21751 (DOE/ER/10160—T3)

**Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center**
Design and testing of a procedure for evaluating fuel-efficient crankcase lubricants, 6:21592 (DOE/BETC/RI—81/2)

**Department of Energy, Laramie, WY (USA). Laramie Energy Technology Center**
Hydrocarbon type analysis of jet fuels by $^{1}H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)

**Department of Energy, Las Vegas, NV (USA). Nevada Operations Office**
Nevada nuclear waste storage investigations. Quarterly report, October-December, 1980, 6:21674 (NVO—196-21)

**Department of Energy, New York (USA). Environmental Measurements Lab.**
Environmental Measurements Laboratory annual report, calendar year 1980, 6:22672 (DOE/EML—392)

**Department of Energy, Oak Ridge, TN (USA). Technical Information Center**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)

**Department of Energy, Washington, DC (USA)**
International Energy Conservation Month: an assessment, 6:22258 (DOE/TIC—1022137)
Some aspects of the study of gas-discharge plasma and production of high magnetic fields, 6:22152 (DOE-tr—73)

**Department of Energy, Washington, DC (USA). Office of Energy Research**
Alternate nuclear waste forms and interactions in geologic media, 6:21653 (CONF-8005107—)

**Department of Energy, Washington, DC (USA). Office of Inspector General**
Office of the Inspector General. Annual report, 6:22967 (DOE/IG—0008/1)

**Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs**
Class 1 nuclear components (supplement to ASME Boiler and Pressure Vessel Code, Section III, Subsections NCA and NB), 6:22045 (NE-E—15-2NB-T(Rev.)(1-81))
Martensitic stainless steel (Type 403) forgings (ASME SA-182 with additional requirements), 6:22284 (NE-M—2-6T(4-81)(Rev.))

**Department of Energy, Washington, DC (USA). Office of Transportation Programs**
Hydrogen-via-Electricity concept. Critique report, 6:21725 (DOE/CE—0005)

**Department of Housing and Urban Development, Washington, DC (USA). Office of Policy Development and Research**
Phase two report for the development of energy performance standards for new buildings. Appendix D. Energy conscious designs, 6:22197 (DOE/TIC—11456)
Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings, 6:22222 (DOE/TIC—11459)

**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**
Combustion-rate predictions for controlled-air incinerators, 6:21670 (DP-MS—81-8)
Computational codes for calculating dispersion from accidental releases of pollutants, 6:22543 (DP-MS—80-85)
Design and operation of a prototype incinerator for beta-gamma waste, 6:21669 (DP-MS—80-123)
Flagstaff $1^{0}$ x $2^{0}$ NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Gamma-ray monitor for plutonium uniformity in fuel tubes, 6:22054 (DP-MS—80-120)
Marble Canyon $1^{0}$ x $2^{0}$ NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
Modeling pollutant dispersion within a tornadic thunderstorm, 6:22542 (DP-MS—80-84)
Portland $1^{0}$ x $2^{0}$ NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)

**Duquesne Light Co., Shippingport, PA (USA)**
1980 annual radiological environmental report. Volume 2, 6:22057 (DOE/PN/00293—T1)

**Dynatech R/D Co., Cambridge, MA (USA)**
Feasibility study for anaerobic digestion of agricultural crop residues. 1980 update. Final report, 6:21730 (SERI/TR—98175-1)

## E

**Earth Sciences Associates, Palo Alto, CA (USA)**
Problem definition study of subsidence caused by geopressured geothermal resource development, 6:21969 (LBL—12392)

**ECA, Inc., Woodridge, IL (USA)**
Atmospheric corrosion of batten and enclosure materials for flat-plate solar collectors, 6:21936 (ANL/EES-TM—135)

**EDAW, Inc., Palo Alto, CA (USA)**
Problem definition study of subsidence caused by geopressured geothermal resource development, 6:21969 (LBL—12392)

**EG and G Idaho, Inc., Idaho Falls (USA)**
Agriculture, greenhouse, wetland and other beneficial uses of geothermal fluids and heat, 6:21976 (CONF-810471—1)
Identification of multivariate linear systems, 6:22971 (CONF-810406—5)
Methodologies for calculating measurement uncertainties, 6:22972 (CONF-810406—7)
Three Mile Island Unit-2 core status summary: a basis for tool development for reactor disassembly and defueling, 6:22076 (GEND—007)
Two-phase velocity and density in finite pipes by intrusive and nonintrusive instrumentation, 6:22074 (EGG-M—00881)
User's guide to ANYOLS: a flexible stepwise regression program, 6:22973 (EGG-EA—5455)

**EG and G, Inc., Las Vegas, NV (USA)**
Commentary on differential-pressure measurements at high reference pressures, 6:22442 (EGG—1183-1800)

High-speed photodetector for plasma diagnostics, 6:22879 (LA-UR—81-1028)
Pulsating-flow measurement with an orifice flange, 6:21971 (EGG—1183-1797)

**EG and G, Inc., Los Alamos, NM (USA)**
Occultation of the ATS-3 satellite by the AVEFRIA barium ion cloud, 6:22743 (CONF-810421—3)

**EG and G, Inc., San Ramon, CA (USA). Energy Measurements Group**
EG and G support to LLNL, 1 January 1981-31 March 1981, 6:22528 (EGG—1183-4221)

**EG and G, Inc., Santa Barbara, CA (USA)**
Nanosecond-gating properties of proximity-focused microchannel-plate image intensifiers, 6:22520 (LA-UR—81-1126)

**Electric Power Research Inst., Palo Alto, CA (USA)**
1981-1985 research and development program plan: program descriptions, 6:22134 (EPRI-P—1726-SR)

**Elrick and Lavidge, Inc., San Francisco, CA (USA)**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
Pacific Northwest residential energy survey. Volume 2. Technical appendix, 6:22179 (DOE/BP—13061(Vol.2))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))

**Energy Research Corp., Danbury, CT (USA)**
Development of molten-carbonate fuel-cell technology. Technical status report, August-October 1980, 6:22157 (DOE/ET/11304—T7)
High-temperature molten-carbonate fuel cells. Technical progress report, January-March 1979, 6:22158 (DOE/ET/11304—T10)
Technology development for phosphoric acid fuel cell powerplant (Phase II): 7th quarterly report, 6:22162 (DOE/NASA/0067—79-6)

**Energy Resources Co., Inc., Walnut Creek, CA (USA)**
Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
Low-rank coal study : national needs for resource development. Volume 2. Resource characterization, 6:21543 (DOE/FC/10066—T1(Vol.2))
Low-rank coal study. Volume 5. RD and D program evaluation, 6:21488 (DOE/FC/10066—T1(Vol.5))
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))
Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation, 6:21487 (DOE/FC/10066—T1-(Vol.3))
Low-rank coal study: national needs for resource development. Volume 6. Peat, 6:21544 (DOE/FC/10066—T1(Vol.6))

**Energy Technology Support Unit, Harwell (UK)**
High temperature thermal insulation usage in UK process industries, 6:22245 (NP—1902598)

**Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.**
Mobile source emission inventory, 6:22544 (EPA-AA-TEB—81-11)

**Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.**
Tumorigenesis of diesel exhaust, gasoline exhaust, and related emission extracts on SENCAR mouse skin, 6:22702 (CONF-800323—4)

**E-Tech, Inc., Atlanta, GA (USA)**
Solar-assisted heat pump field performance evaluation. Final report, 6:21859 (DOE/SF/10549—T1)

**Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)**
Design and installation of a pilot-plant to vitrify ICPP-simulated calcined high-level waste, 6:21671 (ENICO—1087)

**Exxon Research and Engineering Co., Florham Park, NJ (USA)**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)

**Exxon Research and Engineering Co., Linden, NJ (USA)**
Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)

**Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.**
Recent progress on Exxon's circulating zinc bromine battery system, 6:22093 (SAND—81-7115C)
Recent technology improvements in Exxon's circulating zinc-bromine battery system, 6:22094 (SAND—81-7116C)
Sputtered amorphous silicon solar cells. Quarterly report No. 2, October 22, 1980-January 22, 1981, 6:21787 (SERI/PR—9219-T1)

## F

**FAFCO, Inc., Menlo Park, CA (USA)**
Second generation ground coupled solar assisted heat pump systems. Six month progress report, 6:21848 (DOE/CS/30224—T1)

**Fermi National Accelerator Lab., Batavia, IL (USA)**
Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)
Introduction to gauge theories of the strong, weak, and electromagnetic interactions, 6:22824 (FERMILAB-Conf—80/64THY)

**Florida International Univ., Miami (USA)**
Greater Caribbean Energy and Environment Future. Ad hoc working group report, Key Biscayne, Florida, October 26-28, 1980, 6:22104 (DOE/EV/10454—T1)

**Florida Solar Energy Center, Cape Canaveral (USA)**
Interstate Solar Coordination Council. Final report, 6:21736 (DOE/CS/30278—T4)

**FluiDyne Engineering Corp., Minneapolis, MN (USA)**
MHD air heater technology development. Annual technical progress report, January 1, 1980-December 31, 1980, 6:22149 (DOE/ET/15602—T4)

**Forest Service, Asheville, NC (USA). Southeastern Forest Experiment Station**
Improving tree growth on poor and medium sites through the use of legumes. Annual report, February 14, 1980-September 1, 1980, 6:22670 (DOE/SR/10702—1)

**Foster Technology Associates, Inc., St. Johns, MI (USA)**
Hydrogen-via-Electricity concept. Critique report, 6:21725 (DOE/CE—0005)

**Foster Wheeler Development Corp., Livingston, NJ (USA)**
Solar repowering/industrial retrofit system for the Provident Energy Company Refinery. Topical report, September 28, 1979-July 15, 1980, 6:21860 (DOE/SF/10606—T1)

## G

**Gary Energy Corp., Englewood, CO (USA)**
Residual-oil-saturation-technology test, Bell Creek Field, Montana. Final report, 6:21572 (DOE/ET/12366—22)

**GCA Corp., Bedford, MA (USA). GCA Technology Div.**
Emissions inventory for the SURE Region. Final report, 6:22545 (EPRI-EA—1913)

**General Accounting Office, Washington, DC (USA)**
Effects of regulation on the electric utility industry, 6:22602 (EMD—81-35)

Improved data and procedures needed for development and implementation of building energy performance standards, 6:22204 (EMD—81-2)

**General Atomic Co., San Diego, CA (USA)**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)
Special applications of gas-cooled reactors, 6:22050 (GA-A—16262)

**General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.**
Low-cost, actively-cooled linear photovoltaic receiver, 6:21780 (SAND—81-7113C)

**General Electric Co., Philadelphia, PA (USA). Space Div.**
Silicon germanium (SiGe) radioisotope thermoelectric generator (RTG) program for space missions. Nineteenth technical progress report, December 1980-January 1981, 6:22153 (DOE/ET/32043—T7)

**General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume I. Final report, 6:22128 (DOE/JPL/955456—1(Vol.1))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume III. Final report, Appendix B: state of the art, trends, and potential growth of selected DSG technologies, 6:22130 (DOE/JPL/955456—1(Vol.3))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume IV. Final report, Appendix C: identification from utility visits of present and future approaches to integration of DSG into distribution networks, 6:22131 (DOE/JPL/955456—1(Vol.4))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume V. Final report, Appendix D: cost-benefit considerations for providing dispersed storage and generation for electric utilities, 6:22132 (DOE/JPL/955456—1(Vol.5))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume II. Final report, Appendix A: selected DSG technologies and their general control requirements, 6:22129 (DOE/JPL/955456—1(Vol.2))

**General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.**
Electrocyclone development program. Quarterly technical report, November 1980-January 1981, 6:22000 (DOE/ET/17091—T1)

**General Electric Co., Schenectady, NY (USA). Gas Turbine Div.**
Development of high-temperature turbine subsystem technology to a technology readiness status, Phase II. Quarterly report, January-March 1981, 6:21995 (DOE/ET/10340—T4)
High-temperature turbine technology program. Turbine subsystem design report: Low-Btu gas, 6:21994 (DOE/ET/10340—T3)

**General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.**
Comparison of semiautomatic and fully automatic water titrators, 6:22327 (GEPP-TIS—569)

**General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.**
Pebble Bed Reactor Plant screening evaluation. Volume 1. Overall plant and reactor system, 6:22047 (DOE/ET/35202—T1(Vol.1))

**Geodata International, Inc., Dallas, TX (USA)**
Aerial radiometric and magnetic study: Wallace National Topographic map, Idaho/Montana. Final report, 6:21626 (GJBX—111(81))
Aerial radiometric and magnetic survey: Driggs National Topographic Map, Idaho/Wyoming. Final report, 6:21623 (GJBX—93(81))
Aerial radiometric and magnetic survey: Pullman National Topographic Map, Idaho/Washington. Final report, 6:21628 (GJBX—117(81))
Aerial radiometric and magnetic survey: Brushy Basin detail survey: Price/Salina national topographic map sheets, Utah. Volume II. Area I: graphic data. Final report, 6:21620 (GJBX—35((81)(Vol.2)(PriceSalina))
Aerial radiometric and magnetic survey: Grand Junction National Topographic map, Colorado, Utah. Final report, 6:21627 (GJBX—112(81))

**Geokinetics, Inc., Concord, CA (USA)**
Investigation of the geokinetics horizontal in situ oil shale retorting process. Quarterly report, January, February, March 1981, 6:21608 (DOE/LC/10787—77)

**Geological Survey, Denver, CO (USA)**
Correlation characteristics of surficial deposits with a description of surficial stratigraphy in the Nevada test site region, 6:22722 (DOE/ET/44802—T1)

**Geological Survey, Idaho Falls, ID (USA). Water Resources Div.**
Hydrologic conditions at the Idaho National Engineering Laboratory, Idaho. Emphasis: 1974-1978, 6:22594 (IDO—22060)

**Geological Survey, Washington, DC (USA)**
Audio-magnetotelluric data log and station-location map for the Silver Star Hot Springs area, Montana, 6:21963 (USGS-OFR—79-1307)
Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: an update, 6:21957 (USGS-OFR—80-490)
Heat flow in relation to hydrothermal activity in the southern Black Rock Desert, Nevada, 6:21964 (USGS-OFR—79-1467)
Preliminary geological interpretation and lithologic log of the exploratory geothermal test well (INEL-1), Idaho National Enginering Laboratory, eastern Snake River Plain, Idaho, 6:21962 (USGS-OFR—79-1248)

**Georgetown Univ., Washington, DC (USA)**
Georgetown University Integrated Community Energy System (GU-ICES). Phase III, Stage I: feasibility analysis. Final report, 6:22192 (DOE/CS/20068—4(Vol.2)(App.))

**George Washington Univ., Washington, DC (USA). Behavioral Studies Group**
California solar energy study: decision-analysis panel report, 6:21738 (DOE/EIA/10189—T3)

**Georgia Inst. of Tech., Atlanta (USA). School of Physics**
Theoretical investigation and calculation of certain atomic and molecular processes important in the formation and destruction of excited stable gas molecules (or excimers). Final report, October 1, 1978-November 30, 1979, 6:22771 (DOE/DP/40017—T1)

**Gilbert/Commonwealth, Reading, PA (USA)**
Evaluation of the nucledyne passive containment system, 6:22025 (ALO—137)

**G K Systems, Inc., Westlake Village, CA (USA)**
Tracking instrument and control for solar concentrators. Final technical report, October 1979-January 1981, 6:21941 (DOE/ET/21109—T1)

**Gould, Inc., Rolling Meadows, IL (USA). Gould Labs.**
Development of a totally maintenance-free, deep-discharge lead-acid battery for photovoltaic applications, 6:22095 (SAND—81-7119C)

## H

**Hanford Engineering Development Lab., Richland, WA (USA)**
Accountability study for TMI-2 fuel, 6:22026 (GEND—016)
Application of software engineering to development of reactor-safety codes, 6:22077 (HEDL-SA—2244-FP)
Application of software to development of reactor-safety codes, 6:22078 (HEDL-SA—2244-S)
Data summary report for the destructive examination of Rods G7, G9, J8, I9, and H6 from Turkey Point Fuel Assembly B17, 6:22027 (HEDL-TME—80-85)
Generic methods for design of small-bore pipe supports, 6:22060 (HEDL-SA—2275-FP)
Irradiated mixed-oxide-fuel and fission-gas-release behavior during ex-reactor thermal-transient tests, 6:22036 (HEDL-SA—2175)
Shield-verification survey of a large hot cell at the FFTF, 6:22059 (HEDL-SA—2044)
Simulation of the fusion materials irradiation test facility lithium and heat transport systems for abnormal events study, 6:22912 (HEDL-SA—2253)

**Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences**
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, January-March 31, 1980, 6:21764 (DOE/ET/23037—3)
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Final technical report, July 1, 1979-June 30, 1980, 6:22311 (DOE/ET/23037—4)

**Harvard Univ., Cambridge, MA (USA). Museum of Comparative Zoology**
Study of mathematical models of mutation and selection in multi-locus systems. Annual progress report, October 1, 1980-September 30, 1981, 6:22637 (DOE/EV/02472—T1)

**Hawaiian Dredging and Construction Co., Honolulu (USA). Advanced Projects Dept.**
Pahoa geothermal industrial park. Engineering and economic analysis for direct applications of geothermal energy in an industrial park at Pahoa, Hawaii, 6:21977 (DOE/ET/27233—T3)

**Hawaii Univ., Honolulu (USA)**
Angular and energy resolution of the DUMAND optical array, 6:22511 (DOE/ER/00511—T1)

**Hawaii Univ., Manoa (USA). Hawaii Natural Energy Inst.**
Guidebook on wind energy-conversion applications in Hawaii, 6:21980 (HNEI—81-01)

**Hemlock Semiconductor Corp., MI (USA)**
Development of a polysilicon process based on chemical vapor deposition (Phase 1). Fifth quarterly progress report, 1 October-31 December 1980, 6:21769 (DOE/JPL/955533—81/5)

**Henningson, Durham and Richardson, Inc., Charlotte, NC (USA)**
Regional resource recovery feasibility study for Western Piedmont and Centralina Council of Governments, 6:22254 (NCEI—0024)

**Hercules, Inc., Cumberland, MD (USA). Allegany Ballistics Lab.**
Safety analysis of the 1000 lb/day coal-liquefaction PDU, 6:21505 (DOE/PC/30198—T5)
Safety analysis of the 700-horsepower combustion test facility, 6:21561 (DOE/PC/30198—T4)

**Hercules, Inc., Cumberland, MD (USA). Hercules Aerospace Div.**
Safety analysis of the CSTR-1 bench-scale coal liquefaction unit, 6:21504 (DOE/PC/30198—T3)

**High Life Helicopters, Inc., Puyallup, WA (USA)**
Airborne gamma-ray spectrometer and magnetometer survey, Wenatchee quadrangle (Washington). Final report, 6:21635 (GJBX—136-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey: Concrete quadrangle (Washington). Final report, 6:21636 (GJBX—136-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach, Seattle, Cape Flattery, Victoria, Quadrangles (Washington). Final report, 6:21629 (GJBX—135-81(Vol.1))
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach quadrangle (Washington). Final report, 6:21630 (GJBX—135-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey: Victoria quadrangle (Washington). Final report, 6:21632 (GJBX—135-81(Vol.2C))
Airborne gamma-ray spectrometer and magnetometer survey, Seattle quadrangle (Washington). Final report, 6:21631 (GJBX—135-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey, Cape Flattery quadrange (Washington). Final report, 6:21633 (GJBX—135-81(Vol.2D))
Airborne gamma-ray spectrometer and magnetometer survey: Wenatchee, Concrete, quadrangles (Washington). Final report, 6:21634 (GJBX—136-81(Vol.1))

**Hughes Aircraft Co., Culver City, CA (USA)**
Pulsed WIP electron gun. Fabrication phase 1 x 40 cm and 1 x 70 cm cooled WIP electron gun. Final report, March 1979-December 1980, 6:22788 (UCRL—15327)

## I

**IBM Federal Systems Div., Huntsville, AL (USA)**
Solar energy system economic evaluation. Final report for IBM system 3, Glendo, Wyoming, 6:21857 (DOE/NASA/CR—161728)
Solar Energy System Economic Evaluation final report for Colt Pueblo, Pueblo, Colorado, 6:21855 (DOE/NASA/CR—161725)
Solar Energy System Economic Evaluation final report for IBM System 4, Clinton, Mississippi, 6:21856 (DOE/NASA/CR—161726)

**Idaho National Engineering Lab., Idaho Falls (USA)**
Some factors affecting the metering of subcooled water with a choked venturi, 6:22071 (CONF-810406—4)

**Illinois State Geological Survey, Urbana (USA)**
Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979, 6:21538 (DOE/MC/08004—T8)

**Illinois Univ., Chicago (USA)**
Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)
Overview of coal-gasification-materials experience in selected pilot plants, 6:21489 (CONF-810417—6)

**Illinois Univ., Urbana (USA)**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
Tunneling of mixed dumbbells in Al-Zn, 6:22268 (DOE/ER/01198—1352)

**Illinois Univ., Urbana (USA). Fusion Studies Lab.**
CTR plasma engineering studies. Annual progress report, 1 October 1980-30 September 1981, 6:22878 (DOE/ET/52040—T2)

**Indiana Geological Survey, Bloomington (USA)**
Stratigraphic cross sections showing members of the New Albany Shale (Devonian and Mississippian) in Indiana, 6:21599 (METC/EGSP—816)

**Indiana Univ., Bloomington (USA)**
Clay mineralogy of selected sediments and soils at the Savannah River Plant, Aiken, South Carolina, 6:22729 (DP-MS—80-119)

**Institute for Energy Analysis, Oak Ridge, TN (USA)**
Petroleum refining industry in the 1980s: impact of the National Energy Plan and related legislation, 6:21591 (ORAU/IEA—81-3(M))

**Institute of Gas Technology, Chicago, IL (USA)**
Manpower requirements for an emerging energy technology: high-Btu coal gasification, 6:21510 (DOE/TIC—1021172)
Overview of coal-gasification-materials experience in selected pilot plants, 6:21489 (CONF-810417—6)

**International Applied Physics, Inc., Dayton, OH (USA)**
150mm launcher facility for shockwave compression experiments: a critical review and conceptual design study, 6:22527 (UCRL—15334)

**International Business Machines Corp., Huntsville, AL (USA). Federal Systems Div.**
Solar energy system economic evaluation. Final report for SEECO Lincoln, Lincoln, Nebraska, 6:21854 (DOE/NASA/CR—161724)

**International Energy Agency Coal Research, London (UK)**
Geophysical examination of coal deposits, 6:21545 (ICTIS/TR—13)

**InterTechnology/Solar Corp., Warrenton, VA (USA)**
Solar-collector studies for solar-heating and -cooling applications. Final report, 6:21939 (DOE/CS/35349—T1)

## J

**JBF Scientific Corp., Wilmington, MA (USA)**
Northeast regional assessment study for solar electric options in the period 1980-2000, 6:21837 (DOE/ET/20375—T1)

**Jet Propulsion Lab., Pasadena, CA (USA)**
Photovoltaics Program: utility interface southwest regional workshop proceedings, 6:21820 (DOE/ET/20356—2)

Vehicle test report: South Coast Technology electric cconversion of a Volkswagen Rabbit, 6:22261 (DOE/CS/54209—2)

**Joint Center for Graduate Study, Richland, WA (USA)**

Investigation of solar cells based on $Cu_2O$. Progress report, June 1, 1980-November 30, 1980, 6:21786 (SERI/PR—9190-1-T1)

## K

**Kansas State Univ., Manhattan (USA)**

Atomic physics of strongly correlated systems, 6:22770 (CONF-810432—4)

**Kayex Corp., Rochester, NY (USA)**

Development of advanced Czochralski growth process to produce low-cost 150-kg silicon ingots from a single crucible for technology readiness. First quarterly progress report, October 1, 1980-December 31, 1980, 6:21771 (DOE/JPL/955733—80/1)

## L

**Lawrence Berkeley Lab., CA (USA)**

Applied battery and electrochemical research program report for fiscal year 1980, 6:22092 (LBL—12514)

Automatic tuning of the LBL Bevalac transfer line, 6:22468 (LBL—11580)

Characterization of the selective reduction of NO by $NH_3$, 6:22465 (LBL—12215)

Combustion diagnostics by tunable atomic line molecular spectroscopy, 6:22364 (LBL—12127)

Determination of relative concentrations of primary and secondary organics and speciation of sulfur compounds by thermal analysis and photoelectron spectroscopy, 6:22546 (LBL—12539)

Electrochemical studies of the film formation on lithium in propylene carbonate solutions under open circuit conditions, 6:22090 (LBL—12102)

Experimental study of the flowfield of a V-shaped premixed turbulent flame, 6:22415 (LBL—12141)

Failure modes of Na-beta alumina, 6:22091 (LBL—12445)

Hydraulic fracturing and overcoring stress measurements in a deep borehole at the Stripa Test Mine, Sweden, 6:21673 (LBL—12478)

Identification of geothermal reserves and estimation of their value, 6:21967 (LBL—11940)

Influence of fuel sulfur on the selective reduction of NO by $NH_3$, 6:21596 (LBL—12128)

Metallic wedge degraders for rapid energy measurement of Bevalac heavy ion beams, 6:22469 (LBL—11726)

Modelling of burning and extinction characteristics of a polymer diffusion flame and comparison with experiment, 6:22416 (LBL—12214)

Modelling summary data, 6:22990 (LBL—12350)

Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)

New approaches to problems of fluid flow in fractured-rock masses, 6:22730 (LBL—12511)

New, rugged, high power Cockcroft-Walton power supply, 6:22489 (LBL—11715)

Nuclear science. Annual report, July 1, 1979-June 30, 1980, 6:22844 (LBL—11588)

Numerical simulation of the transport of intense beams of heavy ions in an electrostatic quadrupole system, 6:22473 (SLAC-PUB—2673)

Operations experience at the Bevalac radiotherapy facility, 6:22491 (LBL—11725)

Performance matching and prediction for Serrazzano geothermal reservoir by means of numerical simulation, 6:21960 (LBL—12174)

Physics and medicine: the Bevatron/Bevalac experience, 1979-1980, 6:22490 (LBL—11719)

Progress in residential energy conservation: a multi country perspective, 6:22206 (LBL—11701)

Recent developments and applications of multi-configuration Hartree-Fock methods. NRCC proceedings No. 10, 6:22777 (LBL—12157)

Reinjection studies of vapor-dominated systems, 6:21968 (LBL—12175)

Role of black carbon in the organic chemistry of atmospheric aerosols, 6:22532 (LBL—12540)

Simplified RF power system for Wideroe-type linacs, 6:22488 (LBL—11713)

Strong ignition limits for methane-hydrogen mixtures, 6:21727 (LBL—12146)

Use of a small off-line computer in the operation of a versatile heavy ion cyclotron, 6:22487 (LBL—11709)

**Lawrence Livermore National Lab., CA (USA)**

Angular measurements in optical testing, 6:22431 (UCRL—84968)

Bilogical effects of ionizing radiation: epidemiological surveys and laboratory animal experiments. Implications for risk evaluation and decision processes, 6:22694 (LBL—12555)

Chemical, physical, and mineralogical characterization of fifteen sandstones for radionuclide sorption studies, 6:21686 (UCID—19034)

Comparison of observed and model-predicted $O_3$ trends, 6:22547 (UCID—19040)

Computer-aided design drafting/manufacturing (CADD/M) facility preparation, 6:22982 (UCRL—84964)

Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems, 6:22446 (UCRL—85366)

Cost justification for an interactive Computer-Aided Design Drafting/Manufacturing system, 6:22984 (UCRL—84966)

Design and fabrication of large- and small-bore railguns, 6:22430 (UCRL—84876(Rev.1))

Development of alternate silicone potting compounds. Volume 8. Development of an alternate substitute for Dow Corning aerospace sealant DC93-122 based on Sylgard 184 and dielectric gel Q3-6527, 6:22306 (UCRL—52434(Vol.8))

Direct observation of explosively induced damage in sandstone with application to reservoir stimulation, 6:21605 (UCRL—85331(Rev.1))

Energy and technology review, 6:22920 (UCRL—52000-81-6)

Experimental and theoretical study of flame inhibition by bromine-containing compounds, 6:21731 (UCRL—85409)

Geohydrology of Enewetak Atoll islands and reefs, 6:22726 (UCRL—85411)

Linear system analysis program: programmer's manual, 6:22979 (UCID—30183)

LLNL underground coal gasification project. Quarterly progress report, October-December 1980, 6:21517 (UCRL—50026-80-4)

Mathematical models for the EPIC code, 6:22859 (UCID—19055)

MAZE: an input generator for DYNA2D and NIKE2D, 6:22265 (UCID—19029)

Metallic and nonmetallic coatings for ICF targets, 6:21720 (UCRL—85140)

Method for chug classification, 6:22083 (UCRL—85707)

Mirror fusion. Quarterly report, July-September 1980, 6:22887 (UCAR—10060-80-3)

Molecular potentials and relaxation dynamics, 6:22790 (UCRL—85577)

Molecular potentials and relaxation dynamics, 6:22791 (UCRL—85577(Rev.1))

Molecular resonance phenomena, 6:22792 (UCRL—85858)

On-board data recorder for hard-target weapons, 6:22530 (UCRL—85730)

Proposed solar-furnace study of zinc sulfate decomposition, 6:21722 (UCRL—85743)

Reliability studies of materials using several LSI-11 based systems, 6:22448 (UCRL—85254)

Results of railgun experiments powered by magnetic flux compression generators, 6:22429 (UCRL—84875(Rev.1))

Selecting and implementing an interactive Computer Aided Design Drafting/Manufacturing (CADD/M) system, 6:22983 (UCRL—84965)

Simulating interactions between turbulence and particles in erosive flow and transport, 6:22443 (UCRL—84691)

Solution of the time-dependent incompressible Navier-Stokes equations via a penalty Galerkin finite element method, 6:22445 (UCRL—85354)

Solution of the time-dependent, three-dimensional incompressible Navier-Stokes equations via FEM, 6:22444 (UCRL—85337)

Status report on the project for a standardized data acquisition system, 6:21877 (UCID—18893)
Study of the global energy balance, 6:22533 (UCRL—85958)
Subnanosecond trigger system for ETA, 6:22457 (UCRL—83992)
Technical evaluation of the adequacy of station electric distribution system voltages for the Yankee Rowe Nuclear Power Station, 6:22028 (UCI—18966)
Translation operator for finite dmensional electromagnetic fields, 6:22866 (UCID—19024)
Ultrasmooth plasma polymerized coatings for laser-fusion targets, 6:21719 (UCRL—84475(Rev.1))
Ultrasonic thermometry in oil shale retorts, 6:21612 (UCRL—85845)
VEPEC: a 3D vector potential equilibrium code for high-beta minimum-B plasma confinement, 6:22888 (UCRL—53099)
Why solar oil shale retorting produces more oil, 6:21611 (UCID—19045)

**Little (Arthur D.), Inc., Cambridge, MA (USA)**
Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)

**L.K.B. Resources, Inc., Syosset, NY (USA)**
Dynamic Test Range I: follow-on. Narrative report, 6:21625 (GJBX—110-81)

**Lockheed Missiles and Space Co., Palo Alto, CA (USA). Lockheed Palo Alto Research Lab.**
Evaluation of alloys for fuel cell heat exchangers. Final report, 6:21511 (EPRI-EM—1815)

**Lockheed Missiles and Space Co., Palo Alto, CA (USA). Research Labs.**
Amorphous thin films for solar-cell applications. Technical progress report, 11 October 1980 to 15 January 1981, 6:21789 (SERI/PR—9237-1-T2)

**Los Alamos National Lab., NM (USA)**
Acoustic radiation patterns for borehole sources, 6:21961 (LA-UR—81-1092)
Antares alignment gimbal positioner, 6:22915 (LA-UR—81-1394)
CAMAC gamma ray scanning system, 6:21697 (LA-UR—81-1512)
Ceramic heat exchangers: manufacturing techniques and performance, 6:22423 (LA-UR—81-1643)
Ceramic heat pipe development. Semi-annual report, 1 October 1980-31 March 1981, 6:22418 (DOE/TIC—1022096)
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
Deposition and retention of plutonium in the United States general population, 6:22556 (LA-UR—81-1175)
Design and fabrication of large- and small-bore railguns, 6:22430 (UCRL—84876(Rev.1))
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
Detonation pressures of PBX-9404, composition B, PBX-9502, and nitromethane, 6:22523 (LA-UR—81-1067)
Eight-chord $CO_2$ interferometer for plasma-density measurements on ZT-40, 6:22880 (LA-UR—81-1148)
Energy technology. Progress report, October-December 1980, 6:22043 (LA—8797-PR)
Evaluation of molybdenum and its alloys, 6:22273 (LA-UR—81-1400)
Experience with a multiprocessor based on eight FPS 120B array processors, 6:22974 (LA-UR—81-1082)
Galactic origin of cosmic rays I, 6:22739 (LA-UR—81-965)
Galactic origin of cosmic rays II, 6:22740 (LA-UR—81-966)
High-speed photodetector for plasma diagnostics, 6:22879 (LA-UR—81-1028)
In-situ optical breakdown: studies for a large $CO_2$ laser amplifier, 6:22914 (LA-UR—81-1245)
Laser-induced breakdown spectroscopy: detecting sodium and potassium in coal gasifiers, 6:22329 (LA-UR—81-1526)
Magnetic refrigeration for spacecraft systems, 6:22421 (LA-UR—81-1084)
Manufacture of triaminotrinitrobenzene, 6:22522 (LA-UR—81-992)
Method of active charge and current neutralization of intense ion beams for ICF, 6:22917 (LA-UR—81-1408)
Multi-energy gamma-ray automated scanning system, 6:22328 (LA-UR—81-1511)
Nanosecond-gating properties of proximity-focused microchannel-plate image intensifiers, 6:22520 (LA-UR—81-1126)
Nuclear accident dosimetry: Los Alamos measurements at the seventeenth nuclear accident dosimetry intercomparison study at the Oak Ridge National Lab., DOSAR Facility, August 1980, 6:22860 (LA—8799-MS)
Nuclear equation of state studied with high-energy heavy ions, 6:22854 (LA-UR—81-1555)
Occultation of the ATS-3 satellite by the AVEFRIA barium ion cloud, 6:22743 (CONF-810421—3)
Optical diagnostics of $CO_2$ laser-fusion targets using backscattered light, 6:22881 (LA-UR—81-1435)
Opto-mechanical devices for the Antares automatic beam alignment system, 6:22913 (LA-UR—81-1229)
Performance summary of the Balcomb solar home, 6:21862 (LA-UR—81-1039)
Preliminary market potential indexing study of the United States for direct gain in new single-family residential construction, 6:21746 (LA-UR—81-1201)
Results of railgun experiments powered by magnetic flux compression generators, 6:22429 (UCRL—84875(Rev.1))
Self-focusing in $SF_6$, 6:22775 (LA-UR—81-1157)
Signal enhancement by spectral equalization of high-frequency broadband signals transmitted through optical fibers, 6:22420 (LA-UR—81-1038)
Small-signal-gain spectrum of an 1800 Torr $CO_2$ amplifier, 6:22434 (LA-UR—81-1232)
Solid-state phase transitions in CuCl under hydrostatic pressures to 12.8 GPa, 6:22312 (LA-UR—81-1443)
Stimulated Raman scattering and four-wave mixing: steady-state plane-wave analytic solutions, 6:22776 (LA-UR—81-1228)
Temporal shaping of nanosecond $CO_2$ laser pulses in multiphoton saturable absorbers, 6:22916 (LA-UR—81-1404)
Ultraviolet phase conjugation and its practical implications, 6:22435 (LA-UR—81-1565)
Ultraviolet-spectrograph lens, 6:22519 (LA-UR—81-1074)
When the hole is dry: the HDR alternative in the cascades, 6:21972 (LA-UR—81-1430)

**Los Alamos Scientific Lab., NM (USA)**
Application of parallel preprocessors in data acquisition, 6:22486 (LA-UR—81-1640)
DOE-2 Verification Project. Phase I. Interim report, 6:22205 (LA—8295-MS)
Environmental and radiological safety studies. Interaction of $^{238}PuO_2$ heat sources with terrestrial and aquatic environments. Progress report, October 1-December 31, 1980, 6:21691 (LA—8811-PR)
Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density, 6:22630 (CONF-8005164—1)
Explosively produced fracture of oil shale, July-September 1979, 6:21607 (LA—8397-PR)
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)
Inspector-instrument interface in portable NDA instrumentation, 6:21695 (LA-UR—81-1402)
870.8-keV gamma ray from $PuO_2$, 6:21696 (LA-UR—81-1510)
Laser damage testing of coated reflectors at excimer laser wavelengths, 6:22436 (LA-UR—81-1567)
Low-level-waste-disposal methodologies, 6:21672 (LA-UR—81-1385)
Materials measurement and accounting in an operating plutonium conversion and purification process. Phase I. Process modeling and simulation, 6:21694 (LA—8809-MS)
Model simplification: a case study of end use demand modeling in the transportation sector, 6:22227 (LA-UR—81-813)
Multistage leaching of spent modified in situ oil shale retorts, 6:21609 (LA—8744-MS)
New era for ultrasonic impact grinding, 6:22422 (LA-UR—81-1316)
Numerical simulation for two-phase jet problem, 6:22080 (LA-UR—81-317)
Particle dynamics in linear resonance accelerators, 6:22480 (LA-tr—80-10)
PHERMEX applications to study high-pressure flow and detonation waves, 6:22524 (LA-UR—81-1270)
PLOT2K: a graphics interface to System 2000, 6:22975 (LA-UR—81-1192)
SPS ionosphere/microwave beam interactions: Arecibo experimental studies, 6:21752 (LA-UR—80-3095)
Studies of the biology and toxicology of oilshale materials, 6:22705 (LA-UR—81-1166)
Torus sector handling system, 6:22485 (LA-UR—81-1324)

## M

**Maine Office of Energy Resources, Augusta (USA)**
Heating oil supply/price monitoring report: Part I. Historic data, August 1978-July 1979. Part II. Current data, August 1979-May 1980, 6:21584 (DOE/EIA/06278—T2)

**Maine State Government, Augusta (USA)**
Distillate price-monitoring system. Final report, 6:21583 (DOE/EIA/06278—T1)

**Mainz Univ. (Germany, F.R.). Zoology Dept.**
Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density, 6:22630 (CONF-8005164—1)

**Martin Marietta Corp., Denver, CO (USA). Denver Aerospace**
SOLPAS: passive solar algorithms. User's manual, 6:21863 (MCR—81-543)

**Maryland Univ., College Park (USA). Dept. of Meteorology**
Study of the global energy balance, 6:22533 (UCRL—85958)

**Maryland Univ., College Park (USA). Dept. of Physics and Astronomy**
Study of instabilities and emittance growth in periodic focusing systems for intense beams. Progress report, Technical report No. PP 81-198, 6:22467 (DOE/ER/05940—2)

**Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)**
Formulation of PBX 9503, 6:22525 (MHSMP—81-25)

**Massachusetts Building Code Commission, Boston, MA (USA)**
Energy-conservation opportunities in lighting, 6:22191 (DOE/CE/60467—02)

**Massachusetts Inst. of Tech., Cambridge (USA)**
Assessment of the magnesium primary production technology. Final report, 6:22267 (DOE/CS/40284—T1)
International uranium market, 6:21651 (MIT-EL—80-014)

**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering**
MIT LMFBR blanket research project. Quarterly progress report, October 1, 1980-December 31, 1980, 6:22035 (DOE/ET/37241—45)

**Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.**
Key contributions in MHD power generation. Quarterly technical progress report, September 1, 1979-November 30, 1979, 6:22145 (DOE/ET/15518—3)

**Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.**
Carlisle house: an all-solar electric residence, 6:21817 (DOE/ET/20279—133)
Effect of electrical-utility-system voltage harmonics on induction motors, 6:21819 (DOE/ET/20279—138)
Liquid photovoltaic/thermal collectors for residential applications, 6:21940 (DOE/ET/20279—137)
Loss of line shutdown for line-commutated utility-interactive inverter, 6:21815 (DOE/ET/20279—128)
Operating experience with the natural bridges national monument photovoltaic power system, 6:21818 (DOE/ET/20279—135)
Operational experiences in lead-acid batteries for photovoltaic systems, 6:21813 (DOE/ET/20279—118)
Performance characteristics of solar-photovoltaic flywheel-storage systems, 6:21762 (DOE/ET/20279—134)
Residential photovoltaic power systems for the northeast, 6:21816 (DOE/ET/20279—132)
Residential photovoltaic system designs, 6:21814 (DOE/ET/20279—123)

**Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice**
Hydrodynamics of coal-liquefaction dissolver configurations, 6:21514 (ORNL/MIT—326)
Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)

**MAXIMA Corp., Bethesda, MD (USA)**
Final summary report on an analysis of selected energy information administration publications, 6:22989 (DOE/EIA/10313—T4)

**Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)**
Nuclear equation of state studied with high-energy heavy ions, 6:22854 (LA-UR—81-1555)

**McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)**
Initial experience and preliminary results: solar collector materials exposure to the IPH site environment, 6:21946 (SAND—81-0290)
Solar repowering/industrial retrofit systems study Gulf Mt. Taylor Uranium Mill solar retrofit system requirements specification, 6:21864 (MDC-G—8163A)

**McDonnell Douglas Astronautics Co., St. Louis, MO (USA)**
Hydrogen in titanium alloys, 6:22270 (DOE/ET/52039—2)

**Meteorology Research, Inc., Altadena, CA (USA)**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)

**Michigan Energy Administration, Lansing (USA)**
Energy audit workbook: for local government and related agencies, 6:22257 (DOE/TIC—1022079)

**Minnick (L. John), Plymouth Meeting, PA (USA)**
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)

**Motorola, Inc., Phoenix, AZ (USA). Solar Energy Dept.**
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells. Quarterly technical progress report No. 2, 1 November 1980-31 January 1981, 6:21788 (SERI/PR—9234-2-T1)

**Mound Facility, Miamisburg, OH (USA)**
Magnetic drive vane pump (Mound drawing No. 18889 and 18890) (12 Mar 1981) (Engineering Materials), 6:22433 (CAPE—2689)
Timer powder-pressing study, 6:22424 (MLM—2826)

**Mueller Associates, Inc., Baltimore, MD (USA)**
Ethanol energy yield per gallon and potential petroleum displacement, 6:22140 (DOE/CE/56051—3)

## N

**National Academy of Sciences - National Research Council, Washington, DC (USA)**
Carbon dioxide effects research and assessment program: flux of organic carbon by rivers to the oceans, 6:22558 (CONF-8009140—)

**National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center**
Performance calculations for 200-1000 MWe MHD/steam power plants, 6:22151 (DOE/NASA/10769—16)
Review of stand-alone photovoltaic application projects sponsored by US DOE and US AID, 6:21822 (DOE/NASA/20485—8)
Test evaluation of a laminated wood wind turbine blade concept, 6:21984 (DOE/NASA/20320—30)

**National Association of Counties Research, Inc., Washington, DC (USA). Energy Project**
Guide to reducing energy use...budget costs. Volume II. Local energy management program, 6:22248 (DOE/CS/60419—T1)

**National Bureau of Standards, Washington, DC (USA)**
Final report on research on optical coatings, 6:22305 (DOE/DP/40094—T1)

**National Bureau of Standards, Washington, DC (USA). Center for Building Technology**
Guidelines for the installation of solar components on low-sloped roofs, 6:21944 (NBS-TN—1134)

**National Bureau of Standards, Washington, DC (USA). Center for Materials Science**
High temperature applications of structural ceramics. Quarterly progress report, January-March 1981, 6:22296 (DOE/OR/20679—T4)

**National Center for Resource Recovery, Inc., Washington, DC (USA)**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)

**National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.**
Review of remote-sensor potential for wind-energy studies, 6:21983 (DOE/ET/23151—80/1)

**National Research Council of Canada, Ottawa, Ontario**
Energy-resource requirements of a solar-heating system, 6:21865 (NP—1902600)

**National Research Council, Washington, DC (USA). Committee on Nuclear and Alternative Energy Systems**
Energy in transition 1985 to 2010: overview. Final report, 6:22097 (DOE/PE/03784—T1)

**Naval Coastal Systems Center, Panama City, FL (USA)**
Test results of heat-exchanger cleaning in support of ocean thermal energy conversion, 6:21841 (DOE/CH/00135—3)
**New England Energy Congress, Somerville, MA (USA)**
Strategy papers prepared by the Implementation Group of the New England Energy Congress, 6:22119 (DOE/TIC—1022409)
**New Jersey Dept. of Energy, Newark (USA)**
Program to monitor the weekly retail price of home-heating fuel oil No. 2 in the State of New Jersey. Year one final report, 6:21585 (DOE/EIA/10169—T1)
**New Mexico Inst. of Mining and Technology, Socorro (USA)**
Displacement of oil by carbon dioxide. Final report, 6:21571 (DOE/ET/12082—9)
Galactic origin of cosmic rays I, 6:22739 (LA-UR—81-965)
Galactic origin of cosmic rays II, 6:22740 (LA-UR—81-966)
**New Mexico Univ., Albuquerque (USA). Dept. of Economics**
Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis. Final report, 6:21667 (DOE/TIC—1021731)
Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis, 6:21668 (DOE/TIC—1022080)
**New Mexico Univ., Albuquerque (USA). Technology Application Center**
Solar photovoltaics: a bibliography with abstracts, 6:21795 (TAC/SP—80-004)
**New York State Dept. of Health, Albany (USA). Div. of Labs. and Research (USA)**
Methane-production-rate studies and gas-flow modeling for the Fresh Kills landfill, 6:21728 (NYSERDA—80-21)
**New York State Dept. of Public Services, Albany (USA)**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**New York State Energy Research and Development Authority, Albany (USA)**
Institutional barriers to energy conservation in Mitchell-Lama housing, 6:22208 (NYSERDA—80-26)
**New York Univ., NY (USA). Inst. of Environmental Medicine**
Temporal aspects of tumorigenic response to individual and mixed carcinogens. Progress report, 6:22719 (DOE/EV/02737—9)
**North Dakota Univ., Grand Forks (USA)**
Conversion of solvent refined lignite into premium liquid fuels. Annual report, January-December, 1980, 6:21502 (DOE/FC/02101—T1)
Quantitation of the reductive cleavage of aryl ethers of SRC and coals. Semi Annual report, September 1980-March 1981, 6:21507 (DOE/PC/30227—T1)
**Northern Research and Engineering Corp., Woburn, MA (USA)**
R and D for improved efficiency small steam turbines. Phase II. Second quarterly technical report, 6:22243 (DOE/ET/15426—4)
**Nuclear Regulatory Commission, Washington, DC (USA)**
Two-phase velocity and density in finite pipes by intrusive and nonintrusive instrumentation, 6:22074 (EGG-M—00881)

## O

**Oakland Univ., Rochester, MI (USA)**
Mechanisms for radiation damage in DNA. Progress report, January 1, 1980-December 31, 1980, 6:22673 (DOE/EV/02364—T1)
**Oak Ridge Associated Universities, Inc., TN (USA)**
Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))
**Oak Ridge Associated Universities, Inc., TN (USA). Inst. for Energy Analysis**
Learning function in nuclear reactor operation and its implications for siting policy, 6:22081 (ORAU/IEA—81-4(M))
**Oak Ridge Gaseous Diffusion Plant, TN (USA)**
Hydrogeochemical and stream sediment reconnaissance basic data for Scottsbluff NTMS Quadrangle, Nebraska and Colorado, 6:21641 (GJBX—145(81))
**Oak Ridge National Lab., TN (USA)**
1979 DOE statistical symposium, 6:21619 (CONF-791016—)
Alternate nuclear waste forms and interactions in geologic media, 6:21653 (CONF-8005107—)
Analytical Chemistry Division. Annual progress report for period ending December 31, 1980, 6:22332 (ORNL—5738)
Appropriate energy technology for urban areas, 6:22247 (CONF-810565—1)
AR and TD fossil-energy-materials program. Quarterly progress report, October-December 1980, 6:21513 (ORNL/FMP—81/1)
BOLD VENTURE COMPUTATION SYSTEM for nuclear reactor core analysis, Version III, 6:22038 (ORNL—5711)
Charge transfer to the continuum by heavy ions in atomic hydrogen, 6:22769 (CONF-810432—3)
Coal conversion solid wastes: characterization for environmental assessment, 6:21515 (ORNL/TM—7533)
Development support by ORNL for TVA AFBC Pilot Plant, 6:21992 (CONF-810567—1)
Effect of lithium diffusion into polycrystalline Si solar cells, 6:21759 (CONF-810526—27)
Energy conservation through site planning: a systems approach, 6:22557 (CONF-810531—1)
Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density, 6:22630 (CONF-8005164—1)
GCFR plenum shield design: exit shield experiment, 6:22040 (ORNL/TM—7715)
GCFR plenum shield design: shield heterogeneity experiment, 6:22039 (ORNL/TM—7714)
High flux isotope reactor quarterly report, July, August, and September of 1980, 6:22065 (ORNL/TM—7819)
Input parameters for LEAP and analysis of the Model 22C data base, 6:22120 (ORNL—5746)
Link between traditional planning and energy management, 6:22112 (CONF-810140—1)
Logistics characterization for regional spent fuel repositories concept, 6:21677 (ONWI—124)
Novel approach to the growth of anaerobic microorganisms, 6:22648 (CONF-810554—1)
Operating experience with LEAP from the perspective of the computing applications analyst, 6:22099 (ORNL/CSD/TM—141)
Optical-absorption measurements of pure and heavily doped silicon from 1.24 to 4.63 eV and the effect on solar-cell performance, 6:21758 (CONF-810526—26(Draft))
Photoexcitation system, 6:21643 (ORNL-tr—4735)
Proceedings of the 1980 DOE statistical symposium, 6:22538 (CONF-801045—)
Proceedings of the energy conservation in design for UCC-ND managers and specialists, 6:22230 (CONF-8003114—)
Pulsed-laser annealing of ion-implanted semiconducting GaAs for homojunction solar cells, 6:21760 (CONF-810526—28(Draft))
Quadrupole mass spectrometer for a mobile laboratory to measure isotope ratios, 6:21693 (CONF-810548—3)
Regional economic and energy consumption implications of the NEP-2 base case scenarios, 6:22121 (ORNL/TM—7199)
Section 316(b) and modeling of ichthyoplankton entrainment, 6:22007 (CONF-810545—2)
Sodium natural convection testing in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility, 6:22072 (CONF-810553—1)
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)
Tumorigenesis of diesel exhaust, gasoline exhaust, and related emission extracts on SENCAR mouse skin, 6:22702 (CONF-800323—4)
Uranium in US surface, ground, and domestic waters. Volume 2, 6:22595 (ORNL/EIS—192/V2)
Uranium in US surface, ground, and domestic waters, 6:22597 (EPA—570/9-81-001(Vol.1))
Uranium in US surface, ground, and domestic waters, 6:22596 (ORNL/EIS—192/V4)
**Ogden (Joan M.), Princeton, NJ (USA)**
Computer simulation of lower-hybrid heating in tokamaks. Final report, 6:22877 (DOE/ER/53106—T1)
**Ohio State Univ., Columbus (USA)**
Ohio State University reactor sharing program. Progress report, September 1, 1980-April 30, 1981, 6:22058 (DOE/ER—10727)
**Ohio State Univ., Columbus (USA). Dept. of Civil Engineering**
Full scale field demonstration of unheated anaerobic contact stabilization. Project status report, October 1980-February 1981, 6:21726 (DOE/CS/24310—3)

**Oklahoma State Univ., Stillwater (USA). School of Technology**
Design and field testing of solar-assisted earth coils. Final report, August 1, 1978-January 31, 1981, 6:21847 (DOE/CS/30210—T1)

**Oklahoma Univ., Norman (USA)**
Use of microorganisms in enhanced oil recovery, 6:21569 (DOE/BC/10300—10)

**Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.**
Silicon solar cell process development, fabrication, and analysis. Eighth quarterly report, 1 October 1980-31 December 1980, 6:21768 (DOE/JPL/955089—80/10)

## P

**Pennsylvania Dept. of Environmental Resources, Harrisburg (USA). Bureau of Topographic and Geologic Survey**
Stratigraphic cross section of the upper Devonian Perrysburg and Java formations and thier equivalents, Northwestern Pennsylvania, 6:21598 (METC/EGSP—14)

**Pennsylvania Univ., Philadelphia (USA). Moore School of Electrical Engineering**
Analysis and evaluation in the production process and equipment area of the low-cost solar-array project. Quarterly report, July-October, 1980, 6:21767 (DOE/JPL/954796—81/12)

**Philadelphia Gas Works, PA (USA)**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)

**Photowatt International, Inc., Tempe, AZ (USA)**
Feasibility study of a microwave application for solar-cell fabrication. Annual report for period ending February, 1981, 6:21781 (SERI/PR—8041-16-T1)

**Physical Sciences, Inc., Woburn, MA (USA)**
Effects of preignition on pulverized-coal combustion. Second quarterly report, 1 January 1981-31 March 1981, 6:21562 (DOE/PC/30293—2)

**Planning and Management Associates of Greater Washington, Inc., DC (USA)**
Local government guide to the emerging technologies of energy-efficient motors and heat pumps. Energy technology report of the energy task force of the urban consortium, 6:22250 (DOE/IR/05106—T8)
Local government guide to the emerging technologies of cogeneration and photovoltaics. Energy technology report of the energy task force of the urban consortium, 6:21821 (DOE/IR/05106—T24)

**Pope, Evans and Robbins, Inc., New York (USA)**
Georgetown University Integrated Community Energy System (GU-ICES). Phase III, Stage I: feasibility analysis. Final report, 6:22192 (DOE/CS/20068—4(Vol.2)(App.))
Rivesville multicell fluidized bed boiler, 6:22003 (DOE/MC/16230—156)
Rivesville multicell fluidized bed boiler. Annual technical progress report. July 1978-June 1979, 6:22001 (DOE/MC/16230—152)
Rivesville multicell fluidized-bed boiler. Annual technical progress report, July 1979-June 1980, 6:22460 (DOE/MC/16230—154)
Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, October-December 1979, 6:22002 (DOE/MC/16230—153)
Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, July-September 1980, 6:22006 (DOE/MC/16230—155)

**Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)

**Princeton Energy Group, NJ (USA)**
Test building instrumentation cooperative agreement: heating/daylighting prototype development. Phase II. Passive and hybrid solar manufactured building project. Project status report No. 2, April 16, 1980-March 16, 1981, 6:21850 (DOE/CS/30367—T1)
Wall collector design analysis: project status report No. 2. Hing/daylighting prototype development, Phase I, 6:21849 (DOE/CS/30367—4)

**Princeton Univ., NJ (USA). Joseph Henry Labs.**
Toroidal magnetic detector, 6:22483 (DOE/ER/03072—1)

**Princeton Univ., NJ (USA). Plasma Physics Lab.**
Bow-shaped toroidal field coils, 6:22918 (PPPL—1790)
Currents generated by lower hybrid waves, 6:22882 (PPPL—1774)
Fusion energy calorimeter for the tokamak fusion test reactor, 6:22885 (PPPL—1791)
Hamiltonian field description of two-dimensional vortex fluids and guiding center plasmas, 6:22884 (PPPL—1783)
Toroidal plasma rotation in the PLT tokamak with neutral-beam injection, 6:22886 (PPPL—1792)
Verification of the classical theory of helical transport in stellarators, 6:22883 (PPPL—1781)

**Public Technology, Inc., Washington, DC (USA)**
Analyzing opportunities for energy conservation in municipal fleet management: service delivery patterns, equipment, supply, operations, and maintenance. Information bulletin of the energy task force of the urban consortium, 6:22226 (DOE/IR/05106—T23)
Local government guide to the emerging technologies of energy-efficient motors and heat pumps. Energy technology report of the energy task force of the urban consortium, 6:22250 (DOE/IR/05106—T8)
Local government guide to the emerging technologies of cogeneration and photovoltaics. Energy technology report of the energy task force of the urban consortium, 6:21821 (DOE/IR/05106—T24)
Status report on energy recovery from municipal solid waste: technologies, lessons and issues. Information bulletin of the energy task force of the urban consortium, 6:22249 (DOE/IR/05106—T6)

**Puerto Rico Univ., Rio Piedras. Center for Energy and Environment Research**
Production of sugarcane and tropical grasses as a renewable energy source. Third quarterly report, December 1, 1980-February 28, 1981, 6:21761 (DOE/ET/20071—T4)

**Puget Sound Council of Governments (USA)**
Energy management workbook for local governments. Workbook 1: electrical energy, 6:22117 (DOE/BP—32)

**Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering**
Mathematical modeling and control of the coke making process, 6:21490 (CONF-810473—1)

## Q

**QEB, Inc., Lakewood, CO (USA)**
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach quadrangle (Washington). Final report, 6:21630 (GJBX—135-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey, Cape Flattery quadrange (Washington). Final report, 6:21633 (GJBX—135-81(Vol.2D))
Airborne gamma-ray spectrometer and magnetometer survey: Wenatchee, Concrete, quadrangles (Washington). Final report, 6:21634 (GJBX—136-81(Vol.1))
Airborne gamma-ray spectrometer and magnetometer survey, Wenatchee quadrangle (Washington). Final report, 6:21635 (GJBX—136-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey: Concrete quadrangle (Washington). Final report, 6:21636 (GJBX—136-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey, Seattle quadrangle (Washington). Final report, 6:21631 (GJBX—135-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey: Victoria quadrangle (Washington). Final report, 6:21632 (GJBX—135-81(Vol.2C))

## R

**Radiation Research Associates, Inc., Fort Worth, TX (USA)**
Effects of overburden, biomass and atmospheric inversions on energy and angular distributions of gamma rays from U, K, Th, and airborne radon sources. Final report, 6:21639 (GJBX—141(81))

**R and D Associates, Marina del Rey, CA (USA)**
Some hydrogen-control considerations for ice-condenser nuclear plants, 6:22082 (UCRL—15345)

**Rasor Associates, Inc., Sunnyvale, CA (USA)**
Advanced thermionic energy conversion. Joint highlights and status report, July-September 1979, 6:22154 (DOE/ET/11293—T3)

**RCA Labs., Princeton, NJ (USA)**
Amorphous silicon solar cells. Quarterly report No. 1, 1 October 1980-31 December 1980, 6:21791 (SERI/PR—9372-1-T1)

**RE/SPEC, Inc., Rapid City, SD (USA)**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)

**Reynolds Metals Co., Sheffield, AL (USA). Energy Conversion Div.**
Microwave gaseous electrode development. Final report, 6:22150 (DOE/ET/15619—T1)

**Rhode Island State Energy Office, Providence (USA)**
State of Rhode Island No. 2 heating oil data collection program. Final report, August 27, 1979-May 22, 1980, 6:21587 (DOE/EIA/10297—T1)

**Rice Univ., Houston, TX (USA)**
Methods development and applications evaluations of NURE aerial reconnaissance survey data for uranium resource evaluation: Beeville/Bay City and Crystal City quadrangles, Texas, 6:21621 (GJBX—69(81))

**Rochester Univ., NY (USA). Dept. of Physics and Astronomy**
Effect of propagation of coherent pulses on multiple-photon excitation, 6:22789 (UCRL—83764)

**Rochester Univ., NY (USA). Dept. of Radiation Biology and Biophysics**
Analysis of cells isolated from bone cultured on collagen gels and polystyrene culture dishes, 6:22631 (UR—3490/LCP-22)

**Rockwell International Corp., Golden, CO (USA). Energy Systems Group**
Fabricating tungsten crucibles by drawing and extrusion spinning, 6:22277 (RFP—3049)

**Rockwell International Corp., Richland, WA (USA). Energy Systems Group**
Determination of EDTA and HEDTA in Hanford defense waste by high-performance liquid chromatography, 6:22336 (RHO-SA—218)

**Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations**
Spent-fuel dry-storage-concept evaluation, 6:21683 (RHO-CD—972)

**Rockwell International Corp., Thousand Oaks, CA (USA). Science Center**
Studies of the mechanism of coal hydrogenation by electron spin resonance. Quarterly technical progress report No. 4, 1 September 1980-31 November 1980, 6:21503 (DOE/PC/30072—T3)
Study program for encapsulation materials interface for low-cost solar array. Annual report, January 1, 1980-December 31, 1980, 6:21766 (DOE/JPL/954739—4)

## S

**Sandia Labs., Livermore, CA (USA)**
Experimental investigation into the application of spontaneous Raman scattering to spray measurements in an engine, 6:22259 (SAND—81-8642)

**Sandia National Labs., Albuquerque, NM (USA)**
Accelerometer measurements of aerodynamic torque on the DOE/Sandia 17-m Vertical Axis Wind Turbine, 6:21987 (SAND—80-2776)
Analysis of protection requirements for away-from-reactor spent fuel storage facilities, 6:21650 (SAND—81-0605C)
Analytical studies of a parabolic line concentrator utilizing an aluminum honeycomb support structure and a thin glass reflector laminate, 6:21945 (SAND—80-1583)
Applications of reflection seismics to mapping coal-seam structure and discontinuities, 6:21546 (SAND—81-1069C)
Array subsystem development for photovoltaic-array fields, 6:21824 (SAND—81-1193C)
Cell string model with mirror gap shading for a parabolic-trough photovoltaic collector, 6:21775 (SAND—81-0069)
Cleaning strategies for parabolic-trough solar-collector fields; guidelines for decisions, 6:21948 (SAND—81-0385)
Compatibility of Fresnel lenses and photovoltaic cells in concentrator modules, 6:21777 (SAND—81-1191C)
Concepts on integration of physical protection and material accounting functions in a safeguards system, 6:21698 (SAND—81-0495C)
Description of the barium cloud vectoring systems developed for the PLACES test series, 6:22745 (SAND—81-0483)
Description of the wind profile system developed for the PLACES test series, 6:22744 (SAND—81-0482)
Development and testing of FIDELE: a computer code for finite-difference solution to harmonic magnetic-dipole excitation of an azimuthally symmetric horizontally and radially layered earth, 6:22521 (SAND—81-0196)
Digitally controlled x-ray mapping, 6:22337 (SAND—81-0331C)
Direct observation of a sand-propped hydraulic fracture, 6:21603 (SAND—81-0225)
Discussion of the role of distributed effects in latch-up, 6:22456 (SAND—81-0658C)
Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)
Experimental parabolic trough collector performance characterization, 6:21947 (SAND—81-0313)
Finite element model for heat conduction in jointed rock masses, 6:21684 (SAND—80-2016)
Geothermal technology publications and related reports: a bibliography, January 1977-December 1980, 6:21954 (SAND—81-0662)
Guy-cable design and damping for vertical-axis wind turbines, 6:21986 (SAND—80-2669)
Implementation plan (May 1979): batteries for specific solar applications, 6:21773 (SAND—80-0216)
Incentives for solar energy in industry, 6:21747 (SAND—81-0048)
Initial experience and preliminary results: solar collector materials exposure to the IPH site environment, 6:21946 (SAND—81-0290)
Interdigitated back contact solar cell with high-current collection, 6:21774 (SAND—80-2206C)
Local design specifications for the CCN security controller (SC), 6:22977 (SAND—81-0994)
Nuclear microprobe analysis, 6:22787 (SAND—81-0203C)
Oil shale program. Twentieth quarterly report, October 1980-December 1980, 6:21610 (SAND—81-1038)
On-site data acquisition system for photovoltaic applications experiments, 6:21823 (SAND—81-0897)
Overview: recent developments and potential of photovoltaic concentrating collectors, 6:21779 (SAND—81-1222C)
Photovoltaic concentrator technology, 6:21778 (SAND—81-1211C)
Power-cable-carrier control ($PC^3$) system, 6:21839 (SAND—81-0113)
Pressure-induced change in the Fermi surface and electronic structure of metals, 6:22279 (SAND—81-0558C)
Program for the improvement of downhole drilling motor bearings and seals. Phase IV. Final report, 6:21973 (SAND—81-7066)
Project PROPA-GATOR: intermediate range explosion airblast propagation measurements, 6:22526 (SAND—80-1880C)
Pulsed power for electromagnetic launching, 6:22426 (SAND—80-1987)
Quantitative x-ray microanalysis of U-Nb alloys with the scanning transmission electron microscope, 6:22278 (SAND—81-0147C)
Radiation environment behind CdO loaded polyethylene conversion material exposed to a fast burst reactor, 6:22062 (SAND—81-0749C)
Radiation-induced conductivity and high-temperature Q changes in quartz resonators, 6:22518 (SAND—81-0126C)

Real-time performance testing of photovoltaic-concentrator modules, 6:21776 (SAND—81-1145C)
Recent Darrieus vertical-axis wind turbine aerodynamical experiments at Sandia National Laboratories, 6:21988 (SAND—81-1108C)
SNLA terminal switching network, 6:22976 (SAND—81-0691C)
Strategic petroleum reserve (SPR) geological site characterization report, Bayou Choctaw Salt Dome. Sections I and II, 6:21595 (SAND—80-7140)
Strategic petroleum reserve (SPR) geotechnical program management and program plan issue C, 6:21594 (SAND—80-2871)
Transient stress analysis of high-energy gas-fracture experiments, 6:21604 (SAND—81-0703)
Two-dimensional temperature distribution surrounding an injection well, 6:21573 (SAND—81-0101C)
Utilization of hybrid computational equipment for the simulation of parachute system flight, 6:22427 (SAND—80-2549C)

**Science Applications, Inc., Canoga Park, CA (USA)**
Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)

**Science Applications, Inc., La Jolla, CA (USA)**
Cooling-and-heating-load improvements in seasonal-performance modeling of room and central air conditioners and heat pumps, 6:22213 (SAI—444-80-299-LJ)

**Science Applications, Inc., Morgantown, WV (USA)**
Quantitative analysis of the economically recoverable resource, 6:21597 (DOE/MC/08216—157)

**Science Applications, Inc., Oak Ridge, TN (USA)**
Considerations for development of specifications for subsurface waste-handling equipment, 6:21676 (ONWI—75)
Retrievability: technical considerations, 6:21678 (ONWI—203)

**Scripps Institution of Oceanography, La Jolla, CA (USA)**
Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)

**Smithsonian Astrophysical Observatory, Cambridge, MA (USA)**
Carbon and carbon-14 in lunar soil 14163, 6:22737 (BNL—29527)

**Solar Design Associates, Lincoln, MA (USA)**
Carlisle house: an all-solar electric residence, 6:21817 (DOE/ET/20279—133)

**Solar Energy Research Inst., Golden, CO (USA)**
MIS silicon solar cells: potential advantages, 6:21793 (SERI/TP—612-1190)
Ocean energy conversion systems annual research report, 6:21843 (SERI/TR—634-1011)
Photovoltaic commercialization: an analysis of legal issues affecting a government-accelerated solar industry, 6:21753 (SERI/TR—434-423)
Solar ponds, 6:21949 (SERI/TR—731-587)

**South Carolina Energy Research Inst., Columbia (USA)**
Residual energy applications program systems analysis report, 6:22241 (DOE/ET/12866—3)

**South Carolina Univ., Columbia (USA). Coll. of Engineering**
Combustion-rate predictions for controlled-air incinerators, 6:21670 (DP-MS—81-8)

**SRI International, Menlo Park, CA (USA). Engineering Sciences Lab.**
Application of microfabrication technology to thermionic energy conversion. Progress report No. 5, August 1, 1980-October 31, 1980, 6:22155 (DOE/ET/15423—5)
Application of microfabrication technology to thermionic energy conversion. Progress report No. 6, November 1, 1980-January 31, 1981, 6:22156 (DOE/ET/15423—6)

**Stanford Linear Accelerator Center, CA (USA)**
Applicability of the FASTBUS standard to distributed control, 6:22503 (SLAC-PUB—2703)
Computer simulation of longitudinal single-bunch effects in electron-positron storage rings, 6:22476 (SLAC-PUB—2688)
Control electronics of the PEP RF system, 6:22493 (SLAC-PUB—2664)
Experimental observations and theoretical models for beam-beam phenomena, 6:22478 (SLAC-PUB—2700)
Final accelerator inter-segment alignment procedure for sectors one and two: fabricating procedure Nos. L-2, A-8, A-11 and O-1. Assembly procedure for assembly of 40 ft segments, 6:22508 (DOE/SF/00515—T1)
High-current injector for the proposed SLAC linear collider, 6:22501 (SLAC-PUB—2701)
Internal spin structure of the proton from high energy polarized e-p scattering, 6:22825 (SLAC-PUB—2674)
Luminosity monitor at PEP, 6:22499 (SLAC-PUB—2691)
Mathematical models for the control program of the SLAC linear collider, 6:22472 (SLAC-PUB—2672)
New generation control system at SLAC, 6:22504 (SLAC-PUB—2704)
Non-linear optics for the final focus of the single-pass-collider, 6:22474 (SLAC-PUB—2678)
Numerical simulation of the transport of intense beams of heavy ions in an electrostatic quadrupole system, 6:22473 (SLAC-PUB—2673)
Operation of PEP longitudinal feedback system, 6:22471 (SLAC-PUB—2670)
Operation of the PEP transverse beam feedback, 6:22477 (SLAC-PUB—2690)
Optical beam diagnostics on PEP, 6:22475 (SLAC-PUB—2683)
PEP storage ring: current status, 6:22497 (SLAC-PUB—2684)
Prospects for very-high-gradient linac-colliders, 6:22498 (SLAC-PUB—2689)
Pulse to pulse klystron diagnosis system, 6:22502 (SLAC-PUB—2702)
Radiation and electrical safety systems for PEP, 6:22494 (SLAC-PUB—2675)
Single bunch beam measurements for the proposed SLAC linear collider, 6:22500 (SLAC-PUB—2698)
Some schemes for on-line correction of the closed orbit, dispersion and beta functions in PEP, 6:22470 (SLAC-PUB—2666)
Superconducting cavities and modulated RF, 6:22496 (SLAC-PUB—2682)
Wigglers: the newest profession, 6:22495 (SLAC-PUB—2677)

**Stanford Univ., CA (USA). Dept. of Civil Engineering**
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980, 6:21729 (SERI/TR—98174-1)

**Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.**
High magnetic field MHD generator program. Final report, July 1, 1976-December 31, 1979, 6:22144 (DOE/ET/10780—T1)

**Stanford Univ., CA (USA). Inst. for Communication Research**
Solar diffusion in California: a pilot study. Consultant report, 6:21737 (DOE/EIA/10189—T1)

**Stanford Univ., CA (USA). Petroleum Research Inst.**
In-situ combustion models for the steam plateau and for fieldwide oil recovery, 6:21570 (DOE/ET/12056—11)

**Stanford Univ., CA (USA). W.W. Hansen Labs. of Physics**
Application of parallel preprocessors in data acquisition, 6:22486 (LA-UR—81-1640)

**Stearns-Roger Services, Inc., Denver, CO (USA)**
Technical summary and index for national waste terminal storage repository No. 1 and No. 2 conceptual design reports, special study No. 6, 6:21679 (ONWI—234)

**Stein (Richard G.) and Partners, New York (USA)**
Handbook of energy use for building construction, 6:22190 (DOE/CE/20220—1)

**Stieff Research and Development Co., Inc., Kensington, MD (USA)**
Preliminary study of the transport and distribution of radium, radon and their alpha-emitting daughters using nuclear emulsions and polonium-210. Final report, 6:21640 (GJBX—144(81))

**Swedish Nuclear Fuel Supply Co., Stockholm**
Hydraulic fracturing and overcoring stress measurements in a deep borehole at the Stripa Test Mine, Sweden, 6:21673 (LBL—12478)

**Swedish State Power Board, Stockholm**
Hydraulic fracturing and overcoring stress measurements in a deep borehole at the Stripa Test Mine, Sweden, 6:21673 (LBL—12478)

**Systan, Inc., Los Altos, CA (USA)**
Evaluation of the Rochester, New York Community Transit Service Demonstration. Volume I: Executive Summary. Final report, November 1977-March 1980, 6:22228 (UMTA-NY—06-0048-81-1)

**Systems Technology Corp., Xenia, OH (USA)**
Evaluation of mixing systems for biogasification of municipal solid waste, 6:22256 (DOE/CS/20100—T2)

## T

**Tata Energy Research Inst., Bombay (India)**
Solid-fuel cooking stoves: bibliography, 6:22207 (NP—1902593)
**Tennessee Technological Univ., Cookeville (USA). Dept. of Chemical Engineering**
Operating temperatures of recessed fluorescent fixtures with thermal insulation, 6:22210 (ORNL/Sub—7715/4)
**Tennessee Univ., Knoxville (USA)**
Charge transfer to the continuum by heavy ions in atomic hydrogen, 6:22769 (CONF-810432—3)
Computational codes for calculating dispersion from accidental releases of pollutants, 6:22543 (DP-MS—80-85)
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**Tennessee Univ., Knoxville (USA). Dept. of Chemical, Metallurgical and Polymer Engineering**
Combined thermodynamic study of nickel-base alloys. Progress report, 6:22271 (DOE/OR/05951—T1)
**Tennessee Valley Authority, Chattanooga (USA)**
Power Program Summary. Volume II. Fiscal year ending June 30, 1980, 6:22138 (TVA/OP/PINF—81/2)
**Texas A and M Univ., College Station (USA)**
Geotechnical studies related to in situ lignite-gasification trials. Semi-annual technical report, October 1, 1980-March 31, 1981, 6:21506 (DOE/PC/30221—T1)
**Texas A and M Univ., College Station (USA). Dept. of Wildlife and Fisheries Science**
Marine mammals of the Southeastern United States coast and the Gulf of Mexico, 6:22572 (FWS/OBS—80/41)
**Texas Tech Univ., Lubbock (USA)**
Cell string model with mirror gap shading for a parabolic-trough photovoltaic collector, 6:21775 (SAND—81-0069)
**Texas Univ., Austin (USA). Applied Research Labs.**
Occultation of the ATS-3 satellite by the AVEFRIA barium ion cloud, 6:22743 (CONF-810421—3)
**Texas Univ., Austin (USA). Bureau of Economic Geology**
Structure of the Presidio Bolson area, Texas, interpreted from gravity data, 6:21959 (DOE/ET/28388—T1)
Using presence of calcite cap rock in shales to predict occurrence of reservoirs composed of leached secondary porosity in the geopressured zone. Annual report, June 1, 1980-October 31, 1980, 6:21958 (DOE/ET/27111—2)
**Texas Univ., Austin (USA). Center for Energy Studies**
Operations research and systems analysis of geopressured/geothermal resources in Texas. Final report, 6:21966 (DOE/ET/27087—T1)
**Texas Univ., Austin (USA). Center for Particle Theory**
Higher-order JWKB expressions for the energy levels and the wavefunction at the origin, 6:22823 (DOE/ER/03992—423)
**Tracor MBA, San Ramon, CA (USA)**
Process development for automated solar-cell and module production. Task 4. Automated array assembly. Quarterly report No. 3, 6:21770 (DOE/JPL/955699—81/03)
**TRW Defense and Space Systems Group, Redondo Beach, CA (USA)**
Method of active charge and current neutralization of intense ion beams for ICF, 6:22917 (LA-UR—81-1408)
Microwave plasma source for neutral-beam injection systems. Quarterly technical progress report, 6:22911 (DOE/ER/52071—T1)
**TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.**
Discount rate in the spent fuel storage and disposal fee, 6:21649 (ONWI—189)

## U

**Union Carbide Corp., Sistersville, WV (USA)**
Low cost solar array project. Quarterly progress report, January-March, 1981, 6:21765 (DOE/JPL/954334—18)
**United Technologies Corp., South Windsor, CT (USA). Power Systems Div.**
Investigation of carbon-formation mechanisms and fuel-conversion rates in the adiabatic reformer. Annual report, March 19, 1980-March 19, 1981, 6:22161 (DOE/MC/14395—T1)
**US Conference of Mayors, Washington, DC. Energy Program**
Guide to reducing energy use...budget costs. Volume II. Local energy management program, 6:22248 (DOE/CS/60419—T1)
**USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**USDOE Bonneville Power Administration, Portland, OR**
Energy management workbook for local governments. Workbook 1: electrical energy, 6:22117 (DOE/BP—32)

## V

**Varian Associates, Palo Alto, CA (USA). Solid State Lab.**
InP single-junction concentrator cell. Semi-annual report, October 1, 1980-March 31, 1981, 6:21790 (SERI/PR—9354-T1)
**VSE Corp., Alexandria, VA (USA)**
OTEC support services. Quarterly technical progress report No. 12, 15 February-14 May 1981, 6:21842 (DOE/ET/21002—T14)

## W

**Washington State Energy Office, Olympia (USA)**
Current energy research and development in Washington State, 1980, 6:22107 (WAOENG—80-17)
**Washington Univ., Seattle (USA). Nuclear Physics Lab.**
Improved two-loop beam energy stabilizer for an FN tandem accelerator, 6:22482 (DOE/ER/01388—489)
Investigation of periodic acceleration tube discharges with a capacitive pickup array, 6:22466 (DOE/ER/01388—488)
**WESTEC Services, Inc., Albuquerque, NM (USA)**
Baca Geothermal Demonstration Project. Quarterly technical progress report, April 1-June 30, 1980, 6:21970 (DOE/ET/27163—1)
Baca Geothermal Demonstration project legal and regulatory challenges. First semi-annual report for period through June 30, 1980, 6:21965 (DOE/ET/27163—2)
**Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry**
Fundamentals of nitric oxide formation in fossil fuel combustion. Progress report, 29 June-28 September 1980, 6:22414 (DOE/ET/10593—T1)
**Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.**
Comparison of LMFBR piping response obtained using response spectrum and time history methods, 6:22073 (CONF-810625—15)
Experimental benchmark for piping system dynamic-response analyses, 6:22032 (CONF-810625—13)
Implications of stress range for inelastic analysis, 6:22033 (CONF-810625—14)
Simplified inelastic analysis procedure to evaluate a butt-welded elbow end, 6:22034 (CONF-810625—16)
Status of the CRBRP steam-generator design, 6:22031 (CONF-810615—2)
**Westinghouse Electric Corp., Pittsburgh, PA (USA)**
Evaluation of the nucledyne passive containment system, 6:22025 (ALO—137)
**Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.**
Spent fuel dry storage technology development: thermal evaluation of isolated drywells containing spent fuel (1 kW PWR spent fuel assembly), 6:21648 (DOE/NV/00597—5)
**Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center**
Low-cost evacuated-tube solar collector appendices. Final report, 6:21938 (DOE/CS/30133—T1(Vol.2))
Thin film battery/fuel cell power generation system. Topical report covering Task 5: the design, cost and benefit of an industrial cogeneration system, using a high-temperature solid-oxide-electrolyte (HTSOE) fuel-cell generator, 6:22159 (DOE/ET/11305—T8)

**Westinghouse Electric Corp., Tampa, FL (USA). Nuclear Equipment Div.**
Development of automated welding process for field fabrication of thick walled pressure vessels. Second quarterly report, FY 1981, 6:22051 (DOE/OR/13511—T1)

**Westinghouse Electric Corp., Trafford, PA (USA). Power Circuit Breaker Div.**
Evaluation, design, development and delivery of a 1200-kV prototype termination. Ninth technical progress report, December 1, 1980-February 28, 1981, 6:22012 (DOE/ET/29068—T5)

**Westinghouse Hanford Co., Richland, WA (USA)**
Thermowell flow-induced vibrations measured in laboratory and FFTF plant piping, 6:22061 (HEDL-SA—2278-FP)

**Westinghouse Research and Development Center, Pittsburgh, PA (USA)**
Low-cost evacuated-tube solar collector. Final report, 6:21937 (DOE/CS/30133—T1(Vol.1))

**Whitston Associates, Pasadena, CA (USA)**
Assessment of the use of human factors in the design of fossil-fired steam-generating systems. Final report, 6:22004 (EPRI-CS—1760)

**Wisconsin Univ., Madison (USA)**
Hydraulic fracturing and overcoring stress measurements in a deep borehole at the Stripa Test Mine, Sweden, 6:21673 (LBL—12478)

**Wisconsin Univ., Madison (USA). Extension**
Energy conservation manual for water & wastewater facilities, 6:22251 (DOE/TIC—1021175)
Municipal energy conservation manual, 6:22252 (DOE/TIC—1021874)

**Wormser Engineering, Inc., Middleton, MA (USA)**
Multi-stage desulfurizing fluid-bed combustor for coal-fired hot gas generator systems: Topical report No. 3. Task 6. Modifications to Materials Handling Equipment. Task 7. Testing, 6:22459 (DOE/ET/10484—T2)

## Y

**Yale Univ., New Haven, CT (USA). Dept. of Physics**
Internal spin structure of the proton from high energy polarized e-p scattering, 6:22825 (SLAC-PUB—2674)

# AUTHOR INDEX

Authors' surnames are indexed in the form appearing in the abstracted publication; given names are reduced to initials. Each author entry gives the publication title and the citation number. Report numbers, if applicable, are given in parentheses at the end of the entry. For publications with multiple authors, an author entry is provided for each. Entries for the second and succeeding authors give references to the first author.

Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. Changes in spelling introduced as a result of accent omission follow standard conventions.

## A


**Aaron, W.S.,** *See* Kobisk, E.H., 6:21663
**Abbott, W.,** *See* Cohen, A.D., 6:21550
**Abel, K.D.,** *See* Harper, J.A., 6:21598
**Abraham, M.M.,** Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—, pp 144-169)
*See* Floran, R.J., 6:21658
*See* Rappaz, M., 6:21657
**Abramson, J.J.,** Anionic detergents as divalent cation ionophores across black lipid membranes, 6:22627
**Abu-Dari, K.,** *See* Raymond, K.N., 6:22698
**Accortt, J.I.,** *See* Plumley, A.L., 6:21991
**Achatz, M.,** *See* Mullaney, P.F., 6:22630
**Ache, H.J.,** *See* Berei, K., 6:22409
**Ackerhalt, J.R.,** Novel analytic solutions to general four-wave-mixing problems in a Raman medium, 6:22874
Self-focusing in $SF_6$, 6:22775 (LA-UR—81-1157)
Stimulated Raman scattering and four-wave mixing: steady-state plane-wave analytic solutions, 6:22776 (LA-UR—81-1228)
**Acquista, N.,** Spectrum and energy levels of nine-times ionized strontium [Sr X], 6:22347
**Adams, C.,** *See* Millet, M.S., 6:22216
**Adams, J.A.,** *See* Bacostow, R.B., 6:22550
**Adams, J.A.S.,** Methods development and applications evaluations of NURE aerial reconnaissance survey data for uranium resource evaluation: Beeville/Bay City and Crystal City quadrangles, Texas, 6:21621 (GJBX—69(81))
**Adhikarya, R.,** *See* Rogers, E.M., 6:21737
**Adler, H.H.,** Some concepts of favorability for world-class-type uranium deposits in the northeastern United States, 6:21622 (GJBX—80(81))
**Adler, H.I.,** Novel approach to the growth of anaerobic microorganisms, 6:22648 (CONF-810554—1)
**Aghamir, F.,** *See* Borst, W.L., 6:21953
**Agrawal, G.P.,** Analytic evaluation of interference effects on laser output in a Fabry-Perot resonator, 6:22438
**Ahluwalia, R.K.,** *See* Im, K.H., 6:22143
**Ahmed, M.,** *See* Kennish, W.J., 6:21904
**Ahmed, S.F.,** Passive ventilation of an underground bath house by the use of solar chimney, 6:21890
**Aho, J.M.,** *See* Hazen, T.C., 6:22659
**Aigner, D.J.,** Correcting for truncation bias in the analysis of experiments in time-of-day pricing of electricity, 6:22139
**Aiman, W.R.,** Why solar oil shale retorting produces more oil, 6:21611 (UCID—19045)
**Albersheim, P.,** *See* Cline, K., 6:22649
**Albert, R.E.,** Temporal aspects of tumorigenic response to individual and mixed carcinogens. Progress report, 6:22719 (DOE/EV/02737—9)
**Alberth, W.,** Galvanic deposition of superinvar alloys, 6:22293 (UCRL-Trans—11676)
**Alder, B.J.,** *See* Pollock, E.L., 6:22816
**Aldrich, M.J.,** Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)
**Alei, M. Jr.,** $^{15}N$ NMR study of complexation of 1-methylimidazole by zinc(II) and cadmium(II) in aqueous soltuion, 6:22389
**Alexander, A.G.,** Production of sugarcane and tropical grasses as a renewable energy source. Third quarterly report, December 1, 1980-February 28, 1981, 6:21761 (DOE/ET/20071—T4)
**Alexander, G.,** Current energy research and development in Washington State, 1980, 6:22107 (WAOENG—80-17)
**Alexander, S.M.,** Analysis of x-ray emission and tritium content from glass Microshell inertial fusion targets, 6:22945
**Alger, T.W.,** *See* Hanson, C.L., 6:22454
**Alkezweeny, A.J.,** Comparison between polluted and clean air masses over Lake Michigan, 6:22549
**Allam, E.M. Sr.,** Laboratory development of /plus or minus/600 kV dc pipe cable system, 6:22013
**Allen, C.P.,** *See* Clark, G., 6:21911
*See* Loxsom, F.M., 6:21930
**Allen, E.L.,** *See* Koshel, P., 6:22167
**Allen, J.D. Jr.,** *See* Becker, R.S., 6:22664
**Allen, M.A.,** Operation of PEP longitudinal feedback system, 6:22471 (SLAC-PUB—2670)
**Alonso, J.,** *See* Lothrop, F., 6:22490
**Alonso, J.R.,** Operations experience at the Bevalac radiotherapy facility, 6:22491 (LBL—11725)
*See* Wada, R., 6:22469
**Alsmiller, R.G. Jr.,** *See* Ford, W.E. III, 6:22099
**Altenbach, T.J.,** *See* McCauley, E.W., 6:22083
**Altshuler, B.,** *See* Albert, R.E., 6:22719
**Alvares, N.J.,** *See* Westbrook, C.K., 6:21731
**Alvis, R.L.,** Power-cable-carrier control ($PC^3$) system, 6:21839 (SAND—81-0113)
**Amelse, J.A. Hill,** Particle size determination in supported $\alpha$-$Fe_2O_3$, 6:22370
**Amer, N.M.,** *See* Jackson, W.B., 6:22439
**Amlin, J.S.,** *See* Kirshen, P.H., 6:21735
**Amundson, P.I.,** *See* Brumbach, S.B., 6:21717
**Anderson, C.A.F.,** *See* Scheetz, B.E., 6:22294
**Anderson, C.W.,** *See* Zorn, G.A., 6:22653
**Anderson, D.V.,** VEPEC: a 3D vector potential equilibrium code for high-beta minimum-B plasma confinement, 6:22888 (UCRL—53099)
**Anderson, M.E.,** *See* Bern, C.J., 6:21879
**Anderson, N.G.,** *See* Edwards, J.J., 6:22622
*See* Giometti, C.S., 6:22623
*See* Hickman, B.J., 6:22620
*See* Taylor, J., 6:22619
*See* Tollaksen, S.L., 6:22624
**Anderson, N.L.,** High-resolution two-dimensional electrophoretic mapping of human proteins, 6:22618
*See* Hickman, B.J., 6:22620
*See* Nance, S.L., 6:22621
*See* Taylor, J., 6:22619
*See* Willard, K.E., 6:22711
**Anderson, P.R.,** Chemical durability improvement of glass shells, 6:22947
**Anderson, V.E.,** *See* Becker, R.S., 6:22664
**Anderson, W.W.,** *See* Jonath, A.D., 6:21789
**Andersson, B.,** *See* Place, W., 6:21921
**Andreev, B.D.,** *See* Gel'perin, N.I., 6:22360
**Andrews, J.E.,** *See* Bedair, S.M., 6:21802
**Angelini, P.,** Sol-gel technology applied to alternative high-level waste forms development, 6:21660 (CONF-8005107—, pp 242-247)
**Angleton, G.M.,** Cumulative survival statistics for Segment III beagles of the CRHL Long-Term Study, 6:22675 (FDA—81-8042, pp 8-11)
Effect of prenatal irradiation on total litter birth weight, 6:22685 (FDA—81-8042, pp 80-84)
Effect of radiation on gestation periods in dams of Segment III beagles, 6:22684 (FDA—81-8042, pp 75-79)
*See* Lee, A.C., 6:22682, 6:22683
*See* Norrdin, R.W., 6:22689
**Annest, J.L.,** Familial aggregation of blood pressure and weight in adoptive families: I. Comparisons of blood pressure and weight statistics among families with adopted, natural, or both natural and adopted children, 6:22641
**Anthony, A.,** *See* Penman, J.A., 6:22660
**Anthony, M.W.,** *See* Joy, D.S., 6:21677

**Antypas, W.G. Jr.,** Restricted rotation in hydroxyphenyl ketones and formaldehydes, 6:22385
**Appelquist, T.,** High-temperature Yang-Mills theories and three-dimensional quantum chromodynamics, 6:22828
**Arbital, J.,** Considerations for development of specifications for subsurface waste-handling equipment, 6:21676 (ONWI—75)
*See* Wilems, R.E., 6:21678
**Arcuri, K.B.,** *See* Amelse, J.A. Hill, 6:22370
**Aris, R.,** *See* Cho, B.K., 6:22361
**Armstrong, L. Jr.,** Summary of QED session, 6:22766 (ANL—80-126, pp 260-271)
**Arney, B.,** When the hole is dry: the HDR alternative in the cascades, 6:21972 (LA-UR—81-1430)
**Arnold, F.H.,** Design considerations for solar dehumidifiers, 6:21887
**Arnold, J.M.,** Overview of coal-gasification-materials experience in selected pilot plants, 6:21489 (CONF-810417—6)
**Aronson, S.J.,** Wall collector design analysis: project status report No. 2. Hing/daylighting prototype development, Phase I, 6:21849 (DOE/CS/30367—4)
**Arora, J.L.,** *See* Punwani, D.V., 6:21531
**Arumi-Noe, F.N.,** *See* Wysocki, M.D., 6:21919
**Arvidson, A.,** *See* McCormick, J., 6:21769
**Asakura, Y.,** *See* Cowder, L.R., 6:21712
**Ashare, E.,** *See* Ruoff, C.F., 6:21520
*See* West, C.E., 6:21730
**Ashby, J.F.,** *See* Ruch, R.R., 6:21538
**Ashley, C.M.,** Innovative, efficient daylighting designs, 6:22215
*See* Kinney, L.F., 6:21912
**Ashley, D.C.,** *See* Ashley, C.M., 6:22215
*See* Kinney, L.F., 6:21912
**Ashman, E.N.,** Solar energy system performance evaluation, October 1979-April 1980: Bond Construction, Gladstone, Missouri, 6:21876 (SOLAR/1050—81/14)
**Atac, M.,** Wire chambers, 6:22512
**Athans, M.,** *See* Lehtomaki, N.A., 6:22022
**Athay, T.A.,** *See* Kwatny, H.G., 6:22018
**Atiya, M.S.,** *See* Russell, J.J., 6:22820
**Atwood, C.L.,** User's guide to ANYOLS: a flexible stepwise regression program, 6:22973 (EGG-EA—5455)
**Aurbach, S.I.,** Environmental toxicology: issues, problems, and challenges, 6:22551
**Averback, E.S.,** Defect clustering in copper, silver and aluminium during heavy-ion irradiations at low temperatures, 6:22272
**Avery, P.,** *See* Russell, J.J., 6:22820
**Avi-Itzhak, T.,** *See* Rogers, E.M., 6:21737
**Ayala, F.J.,** *See* Mueller, L.D., 6:22638

## B

**Baas, D.,** *See* Myers, C.A., 6:22246
**Baccei, B.,** Passive solar manufactured buildings program: useful model for government efforts to assist industry, 6:21900
**Bachmann, A.,** *See* Colberg, P.J., 6:21729
**Backlund, J.C.,** *See* Rhodes, G.W., 6:21848
**Bacon, F.M.,** *See* Walko, R.J., 6:21721
**Bacostow, R.B.,** Atmospheric carbon dioxide, the southern oscillation, and the weak 1975 El Nino, 6:22550
**Bader, B.E.,** Oil shale program. Twentieth quarterly report, October 1980-December 1980, 6:21610 (SAND—81-1038)
**Bader, S.D.,** *See* Richter, L., 6:22289
**Baedecker, M.J.,** *See* Brown, F.S., 6:22581
**Baer, H.W.,** *See* Martoff, C.J., 6:22849
**Bailey, R.B.,** Infrared spectra of carbon monoxide on evaporated nickel films: a low temperature thermal detection technique, 6:22379
**Bair, W.J.,** Historical perspectives on limits for internal emitters, 6:22861 (PNL-SA—9333)
**Baird, J.K.,** Departures from the Stern—Volmer law for fluorescence quenching in liquids, 6:22813
Theory of the Stern—Volmer coefficient for dense fluids, 6:22812
**Bakale, G.,** Electron capture in water pools of reversed micelles, 6:22406
**Baker, A.J.,** *See* Pepper, D.W., 6:22543, 6:22987
**Baker, J.E.,** *See* Oliver, J.A., 6:22004
**Baker, S.I.,** Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)
**Balachandran, A.P.,** *See* Mukunda, N., 6:22868
**Balasubramanian, K.,** Method for nuclear spin statistics in molecular spectroscopy, 6:22796
**Balberg, I.,** *See* Carlson, D.E., 6:21791
**Balcomb, J.D.,** Performance summary of the Balcomb solar home, 6:21862 (LA-UR—81-1039)
**Baldwin, F.D.,** Institutional barriers to energy conservation in Mitchell-Lama housing, 6:22208 (NYSERDA—80-26)
**Balkissoon, I.L.,** *See* Stieff, L.R., 6:21640
**Balko, E.N.,** Effects of ionizing radiation on perfluorosulfonic acid ion-exchange polymer, 6:22308
**Baltisberger, R.J.,** Conversion of solvent refined lignite into premium liquid fuels. Annual report, January-December, 1980, 6:21502 (DOE/FC/02101—T1)
**Bane, K.L.F.,** *See* Wilson, P.B., 6:22476
**Barbera, F.M.,** *See* Stieff, L.R., 6:21640
**Barclay, J.A.,** Magnetic refrigeration for spacecraft systems, 6:22421 (LA-UR—81-1084)
**Baril, E.F.,** *See* Rapaport, E., 6:22614
**Barker, D.B.,** *See* Fourney, W.L., 6:21575
**Barlow, R.S.,** *See* Arnold, F.H., 6:21887
**Barnes, R.N.,** *See* Phung, D.L., 6:21591
**Barnes, S.R.,** *See* Ahmed, S.F., 6:21890
**Barr, D.M.,** Energy management in DOE facilities, 6:22165 (CONF-8003114—, pp 133-143)
**Barraclough, J.T.,** Hydrologic conditions at the Idaho National Engineering Laboratory, Idaho. Emphasis: 1974-1978, 6:22594 (IDO—22060)
**Bartel, L.C.,** *See* Dobecki, T.L., 6:21546
**Bartholf, L.W.,** Thermowell flow-induced vibrations measured in laboratory and FFTF plant piping, 6:22061 (HEDL-SA—2278-FP)
**Bartk, D.E.,** *See* Woolsey, N.F., 6:21507
**Barvir, E.J.,** Hourly use profiles for solar domestic hot water heaters in the National Solar Data Network, 6:21871 (SOLAR/0005—81/80, pp 39-44)
**Bassett, J.L.,** *See* Hasenmueller, N.R., 6:21599
**Battle, G.C. Jr.,** *See* Boatner, L.A., 6:21653
**Batzer, T.H.,** TSTA compound cryopump, 6:22931
**Baugh, K.,** *See* Colberg, P.J., 6:21729
**Baughman, G.L.,** Quantitative expression of biotransformation rate, 6:22591
**Baum, G.,** *See* Hughes, V.W., 6:22825
**Bauman, F.,** *See* Gadgil, A., 6:21920
**Bausman, M.D.,** *See* Hanlon, J., 6:22964
**Baxman, H.R.,** *See* Sprinkle, J.K. Jr., 6:22350
**Beach, L.,** Real-time tritium monitor with an MPC proportional response to airborne mixtures of TH and THO, 6:22515
**Beall, G.W.,** Structure of cerium orthophosphate, a synthetic analogue of monazite, 6:22373
*See* Abraham, M.M., 6:21656
**Beard, C.W.,** *See* Drury, L.N., 6:21883
**Bearden, R.,** *See* Sevilla, M.D., 6:22399
**Beason, D.G.,** *See* Westbrook, C.K., 6:21731
**Beavis, D.,** *See* Lu, J.J., 6:22819
**Beck, G.,** *See* Bakale, G., 6:22406
**Becker, G.W. Jr.,** *See* Farber, M.G., 6:21669
**Becker, R.S.,** Electrical image deposition of charges from laminar flow in cylinders, 6:22664
**Beckman, R.J.,** Help, where are we, 6:21618 (CONF-791016—, pp 209-210)
**Beckman, W.A.,** *See* Siegel, M.D., 6:21828
**Bedair, S.M.,** Efficient use of the slar spectrum through the multiple junction cascade solar cell, 6:21802
**Bedrick, J.R.,** *See* Millet, M.S., 6:22216
**Beecher, D.T.,** Low-cost evacuated-tube solar collector appendices. Final report, 6:21938 (DOE/CS/30133—T1(Vol.2))
**Beethe, R.L.,** *See* Schnizlein, C.T., 6:22708
**Begun, G.M.,** Hydrogen isotope gettering with yttrium metal, 6:22374
**Behar, D.,** Intramolecular electron transfer and dehalogenation of anion radicals. 2. Halonitroaromatic compounds, 6:22407
**Behrsing, G.,** *See* Hinkson, J., 6:22489
**Beinert, H.,** *See* Scott, R.A., 6:22390
**Beitz, J.V.,** *See* Miller, J.R., 6:22381
**Bell, J.T.,** *See* Begun, G.M., 6:22374
**Bellows, R.J.,** Recent progress on Exxon's circulating zinc bromine battery system, 6:22093 (SAND—81-7115C)
Recent technology improvements in Exxon's circulating zinc-bromine battery system, 6:22094 (SAND—81-7116C)
**Ben-Yaakov, S.,** pH buffering of pore water of recent anoxic marine sediments, 6:22575
**Bengston, S.J.,** *See* Bush, W.J., 6:22510
**Benjamin, R.F.,** *See* Liberman, I., 6:22965
**Benjamin, S.A.,** Malignancy as a cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22678 (FDA—81-8042, pp 40-44)
Malignant lymphomas in beagles exposed to low level radiation, 6:22681 (FDA—81-8042, pp 64-66)

Ocular lesions in irradiated beagles, 6:22690 (FDA—81-8042, pp 104-110)
*See* Angleton, G.M., 6:22675
*See* Bishop, L., 6:22676
*See* Brewster, R.D., 6:22686
*See* Stephens, L.C., 6:22677, 6:22679, 6:22680
**Bennett, W.P.,** Local design specifications for the CCN security controller (SC), 6:22977 (SAND—81-0994)
**Beno, M.A.,** *See* Schmidt, G.F., 6:22371
**Benoit, G.J.,** *See* Turekian, K.K., 6:22569
**Bentley, D.,** *See* Haves, P., 6:21886
**Benziger, T.M.,** Manufacture of triaminotrinitrobenzene, 6:22522 (LA-UR—81-992)
**Berei, K.,** Reactions of recoil $^{38}Cl$ in crystalline p-dichlorobenzenes, 6:22409
**Beretvas, A.,** *See* Wilkinson, C., 6:22821
**Berg, R.S.,** Ion beam characteristics of a gas-filled accelerator tube, 6:22809
**Bergeron, K.D.,** Cleaning strategies for parabolic-trough solar-collector fields; guidelines for decisions, 6:21948 (SAND—81-0385)
Incentives for solar energy in industry, 6:21747 (SAND—81-0048)
**Bergkamp, M.A.,** Temperature dependence of the luminescence lifetimes of halopentaammine- and hexaamminerhodium(III) compounds in the solid state, 6:22384
**Bergstroem, M.R.,** *See* Hughes, V.W., 6:22825
**Bergstrom, T.C.,** Capturing oil rents with a national excise tax. Summer Institute paper No. 80-3, 6:22126
**Berguson, W.E.,** *See* Farnham, R.S., 6:21553
**Berkey, B.D.,** Safety analysis of the 700-horsepower combustion test facility, 6:21561 (DOE/PC/30198—T4)
**Bern, C.J.,** Corn drying with solar-dried desiccant, 6:21879
**Bernstein, R.B.,** *See* Lester, M.I., 6:22397
**Berry, G.F.,** *See* Im, K.H., 6:22143
**Berry, H.G.,** *See* DeSerio, R., 6:22765
**Betten, P.R.,** *See* Singer, R.M., 6:22063
**Bettis, E.,** *See* Arbital, J., 6:21676
**Bhagwat, S.B.,** *See* Ruch, R.R., 6:21538
**Bice, D.E.,** *See* Schnizlein, C.T., 6:22708
**Bickes, R.W. Jr.,** *See* Berg, R.S., 6:22809
*See* Walko, R.J., 6:21721
**Biermann, W.J.,** Proprties of the Carrol system and a machine design for solar-powered, air-cooled, absorption space cooling. Phase I and Phase II. Final report, September 1977-March 1979, 6:21851 (DOE/CS/31587—T2)
**Bifano, W.J.,** Review of stand-alone photovoltaic application projects sponsored by US DOE and US AID, 6:21822 (DOE/NASA/20485—8)
**Biljetina, R.,** *See* Punwani, D.V., 6:21518
**Billen, G.,** *See* Wollast, R., 6:22570
**Billings, J.S.,** Evaluation, design, development and delivery of a 1200-kV prototype termination. Ninth technical progress report, December 1, 1980-February 28, 1981, 6:22012 (DOE/ET/29068—T5)
**Bingham, C.D.,** Reference materials and measurement traceability, 6:21701
**Bingham, C.E.,** *See* Connolly, J.M., 6:21929
**Binkley, M.,** *See* Russell, J.J., 6:22820
**Birgeneau, R.J.,** *See* Endoh, Y., 6:22319
**Birkhoff, R.D.,** *See* Becker, R.S., 6:22664
**Birkmire, R.W.,** *See* Hall, R.B., 6:21796
**Biron, P.,** *See* Annest, J.L., 6:22641
**Birtcher, R.C.,** Comments on '30 K fast neutron and fission fragment irradiations of two Fe-B type amorphous alloys', 6:22304
**Bishop, L.,** Principal disease or cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22676 (FDA—81-8042, pp 12-20)
*See* Benjamin, S.A., 6:22678
**Bishop, T.A.,** Evaluation of ECC bypass data with a nonlinear constrained MLE technique, 6:22067 (CONF-791016—, pp 62-70)
Simple models and the comparison of monitoring rules related to National Ambient Air Quality Standards, 6:22539 (CONF-801045—, pp 47-58)
**Bistirlich, J.A.,** Resonances in the trineutron-system, 6:22847
*See* Martoff, C.J., 6:22849
**Bjorken, J.D.,** WKB approximation for general matrix Hamiltonians, 6:22871
**Bjornstad, D.J.,** Regional economic and energy consumption implications of the NEP-2 base case scenarios, 6:22121 (ORNL/TM—7199)
**Bjurstrom, R.G.,** *See* Elliott, C.J., 6:22914
**Black, A.,** *See* Tibbets, G.A., 6:21973
**Blais, N.C.,** Monte Carlo trajectory calculations of the energy of activation for collision-induced dissociation of $H_2$ by Ar as a function of rotational energy, 6:22794
**Blake, R.L.,** *See* Burek, A.J., 6:22742
**Blanpied, M.,** *See* Manning, R., 6:21888
**Blau, G.E.,** *See* Branson, D.R., 6:22587
**Blewitt, T.H.,** *See* Birtcher, R.C., 6:22304
**Blocker, C.,** *See* Donald, M.H.R., 6:22470
*See* Lee, M.J., 6:22472
**Bloom, P.,** Regulatory impact an oil development, 6:22125
**Bloomster, C.H.,** *See* Fassbender, L.L., 6:22255
**Boatner, L.A.,** Alternate nuclear waste forms and interactions in geologic media, 6:21653 (CONF-8005107—)
*See* Abraham, M.M., 6:21656
*See* Beall, G.W., 6:22373
*See* Floran, R.J., 6:21658
*See* Rappaz, M., 6:21657
**Bobrowski, K.,** Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis, 6:22408
**Boccara, A.C.,** *See* Jackson, W.B., 6:22439
**Bodman, G.R.,** *See* DeShazer, J.A., 6:21882
**Boegly, W.J. Jr.,** *See* Lee, S.Y., 6:21515
**Boers, J.E.,** *See* Berg, R.S., 6:22809
*See* Walko, R.J., 6:21721
**Boes, E.C.,** Photovoltaic concentrator technology, 6:21778 (SAND—81-1211C)
*See* Shafer, B.D., 6:21829
**Bogenshutz, A.F.,** *See* Alberth, W., 6:22293
**Bonanos, P.,** Bow-shaped toroidal field coils, 6:22918 (PPPL—1790)
**Bongianni, W.L.,** Acoustic microscopy for ICF target analysis, 6:22940
**Bonn, J.W.,** *See* Hood, C.B., 6:22953
**Boom, R.W.,** *See* Eyssa, Y.M., 6:22085
**Borek, C.,** Scanning electron microscopy of differentiated liver cells transformed in vitro by chemical carcinogens, 6:22635
**Borst, W.L.,** Longterm storage of coolness, 6:21953
**Borzileri, C.,** *See* Chen, H., 6:22799
**Bose, J.E.,** Design and field testing of solar-assisted earth coils. Final report, August 1, 1978-January 31, 1981, 6:21847 (DOE/CS/30210—T1)
**Bossart, L.M.,** Pulsating-flow measurement with an orifice flange, 6:21971 (EGG—1183-1797)
**Bostick, D.T.,** Acid-compensated multiwavelength determination of uranium in process streams, 6:22356
**Bourdo, E.A. Jr.,** Michigan's organic soils - an immense untapped energy resource, 6:21548
**Bowersox, D.F.,** *See* Sampson, T.E., 6:22330
**Bowman, C.F.,** Optimizing power plant coolant systems, 6:21993 (CONF-8003114—, pp 399-414)
**Bowman, H.R.,** *See* Perry, D.L., 6:22340
**Boyd, H.A.,** *See* McInroy, J.F., 6:22556
**Boykin, W.H.,** Application of pattern recognition techniques to a flying robotic arm, 6:22024
**Braeutigam, R.R.,** Analysis of fully distributed cost pricing in regulated industries, 6:22102
**Branson, D.R.,** Material balance approach to estimating aquatic exposure concentrations, 6:22587
**Brant, S.,** *See* Baccei, B., 6:21900
**Brauch, M.L.,** Saddle Hill Trust Lot 73, Medway, Massachusetts: solar energy system performance evaluation, January 1980-December 1980, 6:21875 (SOLAR/1039—81/14)
**Brauer, F.P.,** *See* Goles, R.W., 6:22342
**Breazeal, J.,** *See* Anderson, D.V., 6:22888
**Bremer, D.S.,** Passive education for active professionals: a review of the effectiveness of the passive studio, 6:21891
**Brench, B.L.,** Operational experiences in lead-acid batteries for photovoltaic systems, 6:21813 (DOE/ET/20279—118)
*See* Jarvinen, P.O., 6:21762
**Brennan, R.J.,** *See* Klemm, H.A., 6:22545
**Breslow, M.,** Active solar systems technology, 6:21942 (LA—8797-PR, pp 21-23)
Energy technology. Progress report, October-December 1980, 6:22043 (LA—8797-PR)
Heat pipe technology development, 6:22419 (LA—8797-PR, pp 65-70)
Nuclear criticality experiments and safety, 6:22079 (LA—8797-PR, pp 71-83)
Passive Solar Systems, 6:21861 (LA—8797-PR, pp 3-19)
Solar ponds, 6:21943 (LA—8797-PR, pp 25-31)
Space power advanced reactor (SPAR), 6:22044 (LA—8797-PR, pp 33-53)
Structural mechanics, 6:22052 (LA—8797-PR, pp 55-58)
Thermomechanics, 6:22037 (LA—8797-PR, pp 59-64)
**Breuckels, J.,** *See* Miller, C.W., 6:22645
**Brewer, J.H.,** *See* Fleming, D.G., 6:22380
**Brewster, R.D.,** Case report: study of a beagle with a malignant ectopic thyroid tumor, 6:22692 (FDA—81-8042, pp 117-123)
Testicular atrophy and neoplasia in Segment III beagles sacrificed at 5 and 8 years of age, 6:22686 (FDA—81-8042, pp 85-89)
*See* Benjamin, S.A., 6:22678
*See* Bishop, L., 6:22676

*See* Miller, C.W., 6:22645
*See* Stephens, L.C., 6:22679, 6:22680
**Briggs, J.,** *See* Foerster, C.L., 6:22507
**Brigham, W.E.,** *See* Satman, A., 6:21570
**Bright, R.,** *See* Davitian, H., 6:21748
**Brink, G.O.,** Alternate model of CW dye laser intracavity absorption, 6:22440
**Brixner, B.,** Ultraviolet-spectrograph lens, 6:22519 (LA-UR—81-1074)
**Brodie, I.,** Application of microfabrication technology to thermionic energy conversion. Progress report No. 5, August 1, 1980-October 31, 1980, 6:22155 (DOE/ET/15423—5)
Application of microfabrication technology to thermionic energy conversion. Progress report No. 6, November 1, 1980-January 31, 1981, 6:22156 (DOE/ET/15423—6)
**Brodsky, M.B.,** *See* Richter, L., 6:22289
**Broehl, J.H.,** End-use approach to demand forecasting, 6:22017
**Brooks, A.L.,** Design and fabrication of large- and small-bore railguns, 6:22430 (UCRL—84876(Rev.1))
*See* Hawke, R.S., 6:22429
**Brooks, C.R.,** Combined thermodynamic study of nickel-base alloys. Progress report, 6:22271 (DOE/OR/05951—T1)
**Brooks, R.K.,** Incidence of convulsive seizures in Segment III beagles, 6:22688 (FDA—81-8042, pp 95-98)
*See* Benjamin, S.A., 6:22678
*See* Bishop, L., 6:22676
*See* Brewster, R.D., 6:22686
*See* Stephens, L.C., 6:22679, 6:22680
**Brooks, R.L.,** *See* DeSerio, R., 6:22765
**Brooks, S.O.,** Guide to reducing energy use...budget costs. Volume II. Local energy management program, 6:22248 (DOE/CS/60419—T1)
**Brothers, P.,** *See* Karaki, S., 6:21852
**Brower, D.L.,** *See* Peebles, W.A., 6:22437
**Brown, D.,** *See* Arney, B., 6:21972
*See* Ward, J.W., 6:22292
**Brown, F.S.,** Early diagenesis in a reduced fjord, Saanish Inlet, British Columbia. III. Changes in organic constituents of sediment, 6:22581
**Brown, G.M.,** *See* Malin, J.M., 6:22396
**Brown, K.L.,** Non-linear optics for the final focus of the single-pass-collider, 6:22474 (SLAC-PUB—2678)
**Brown, N.J.,** *See* Cuellar, E., 6:22364
*See* Lucas, D., 6:21596, 6:22465
**Brumbach, S.B.,** In-situ verification techniques for fast critical assembly cores, 6:21717
**Brummett, A.R.,** Initial stages of sperm penetration into the egg of Fundulus heteroclitus, 6:22657
**Bruno, M.J.,** Production of aluminum-silicon alloy and ferrosilicon and commercial purity aluminum by the direct reduction process. First interim technical report, Phase D, January 1-March 31, 1981, 6:22266 (CONS—5089-15)
**Brunschwig, B.S.,** *See* Malin, J.M., 6:22396
**Bryant, J.A.,** *See* Price, T.W., 6:22261
**Buchanan, H.L.,** Mathematical models for the EPIC code, 6:22859 (UCID—19055)
**Bucher, I.Y.,** Experience with a multiprocessor based on eight FPS 120B array processors, 6:22974 (LA-UR—81-1082)
**Buchet, J.P.,** Beam-foil observation of $1s2s^3S$ - $1s2p^3P$ transitions in helium-like $Fe^{24+}$, 6:22764 (ANL—80-126, pp 236-239)
**Buchet-Poulizac, M.C.,** *See* Buchet, J.P., 6:22764
**Buckingham, A.C.,** Simulating interactions between turbulence and particles in erosive flow and transport, 6:22443 (UCRL—84691)
**Buckley, M.,** *See* Stein, R.G., 6:22190
**Buckner, A.T.,** *See* Cady, W.E., 6:22306
**Buddemeier, R.W.,** Geohydrology of Enewetak Atoll islands and reefs, 6:22726 (UCRL—85411)
**Buechele, A.,** *See* De Jonghe, L.C., 6:22091
**Bunce, G.,** *See* Cox, P.T., 6:22818
**Burek, A.J.,** Analyais of solar X-ray emission line profiles, 6:22742
**Burness, H.S.,** Environmental trade-offs with the adoption of cogeneration technologies, 6:22109
*See* Cummings, R.D., 6:21667, 6:21668
**Burnett, B.,** Analysis of large data sets project: computer science research areas, 6:22970 (CONF-791016—, pp 205-208)
**Burns, A.L.,** *See* Chartier, V.L., 6:22015
**Burns, F.J.,** *See* Albert, R.E., 6:22719
**Burns, J.R.,** Cell string model with mirror gap shading for a parabolic-trough photovoltaic collector, 6:21775 (SAND—81-0069)
**Burns, P.J.,** *See* Marshall, L.S., 6:21908
**Burwell, C.C.,** *See* Roberts, P.C., 6:22081
**Busch, R.,** *See* Pawlewicz, W.T., 6:22958
**Busch, R.H.,** Pathologic changes associated with experimental exposure of rats to coal dust, 6:22707
**Bush, G.,** Status report on the project for a standardized data acquisition system, 6:21877 (UCID—18893)
**Bush, W.J.,** Calibration of personnel radiation measurement instruments, 6:22510 (CONF-801045—, pp 36-45)
**Bushaw, B.A.,** Doppler-canceled, two-photon resonant ionization spectroscopy, 6:22805
**Butcher, T.,** *See* Gaffney, J., 6:22260
**Butler, H.S.,** Application of parallel preprocessors in data acquisition, 6:22486 (LA-UR—81-1640)
**Butler, J.,** *See* Russell, J.J., 6:22820
**Butler, M.A.,** Principles of photoelectrochemical, solar energy conversion, 6:21798
**Butler-Gralla, E.,** Variants of 3T3 cells lacking mitogenic response to the tumor promoter tetradecanoyl-phorbol-acetate, 6:22632
**Butt, J.B.,** *See* Amelse, J.A. Hill, 6:22370
**Buxton, W,** *See* Frankel, R., 6:22481
**Bynoe, M.C.,** *See* Saguinsin, J.L.S., 6:22723
**Bzik, D.,** *See* DeLuca, N., 6:22652
**Bzik, D.J.,** Dependence of herpes simplex virus type 1-induced cell fusion on cell type, 6:22650

## C

**Cady, W.E.,** Development of alternate silicone potting compounds. Volume 8. Development of an alternate substitute for Dow Corning aerospace sealant DC93-122 based on Sylgard 184 and dielectric gel Q3-6527, 6:22306 (UCRL—52434(Vol.8))
**Cahill, R.A.,** *See* Ruch, R.R., 6:21538
**Caine, J.C.,** *See* Lee, D.M., 6:21716
**Caine, M.,** *See* Hanlon, J., 6:22964
**Caird, R.S.,** *See* Hawke, R.S., 6:22429
**Cairns, E.,** Applied battery and electrochemical research program report for fiscal year 1980, 6:22092 (LBL—12514)
**Cairns, J. Jr.,** *See* Maki, A.W., 6:22582
**Calcote, M.,** *See* Hanlon, J., 6:22964
**Calkins, N.C.,** New era for ultrasonic impact grinding, 6:22422 (LA-UR—81-1316)
**Call, W.R.,** *See* Batzer, T.H., 6:22931
**Callaham, M.,** *See* Huberman, E., 6:22616
**Callis, R.,** *See* deGrassie, J.S., 6:22927
**Calvin, M.,** Hydrocarbons from plants: analytical methods and observations, 6:21805
**Cameron, A.J.V.,** *See* Revis, N.W., 6:22658
**Camp, D.C.,** Nondestructive, energy-dispersive, x-ray fluorescence analysis of product stream concentrations from reprocessed nuclear fuels, 6:21647
**Campbell, G.,** *See* deGrassie, J.S., 6:22927
**Campbell, K.,** *See* Pirkle, F.L., 6:21642
**Campbell, M.,** *See* Liepins, R., 6:22941
**Campbell, W.B.,** Heterotrophic-photoautotrophic index: a qualitative parameter of microbial interactions applied to a Gulf Stream intrusion, 6:22655
**Canada, T.R.,** Measurement technology for safeguards and materials control, proceedings from American Nuclear Society Topical Meeting, 1979, 6:21700
*See* Sprinkle, J.K. Jr., 6:22350
**Cappiello, C.C.,** *See* Diamond, S.C., 6:22205
**Caputo, A.J.,** *See* Angelini, P., 6:21660
**Carlsith, R.S.,** Conservation research and development, 6:22164 (CONF-8003114—, pp 85-97)
**Carlson, D.E.,** Amorphous silicon solar cells. Quarterly report No. 1, 1 October 1980-31 December 1980, 6:21791 (SERI/PR—9372-1-T1)
**Carlson, R.L.,** *See* Hanlon, J., 6:22964
**Carlson, W.F.,** Simulation of the fusion materials irradiation test facility lithium and heat transport systems for abnormal events study, 6:22912 (HEDL-SA—2253)
**Carlsson, H.,** *See* Doe, T., 6:21673
**Carmichael, I.S.E.,** *See* Ghiorso, M.S., 6:22735
*See* Nelson, S.A., 6:22734
**Carnall, W.T.,** *See* Hessler, J.P., 6:22378
**Carne, T.G.,** Guy-cable design and damping for vertical-axis wind turbines, 6:21986 (SAND—80-2669)
**Carpenter, B.S.,** *See* Canada, T.R., 6:21700
**Carpenter, J.P.,** *See* Elliott, C.J., 6:22914
**Carr, D.B.,** Many facets of large, 6:22969 (CONF-791016—, pp 201-204)
Raster color displays: examples, ideas, and principles, 6:22225 (CONF-801045—, pp 116-126)
**Carr, R.W. Jr.,** *See* Cho, B.K., 6:22361
**Carrig, J.,** *See* Lehtomaki, N.A., 6:22022
**Carroll, J.A.,** Index to quantify thermal comfort in homes, 6:22217
**Carroll, R.D.,** Geophysical investigations in deep horizontal holes drilled ahead of tunnelling, 6:22728

**Carroll, W.,** *See* Place, W., 6:21921
**Carstens, D.H.W.,** Isotope effects in the lanthanum dihydrides, 6:22368
**Carter, J.A.,** *See* Walton, J.R., 6:21693
**Casamajor, A.B.,** *See* Dickinson, W.C., 6:21916
**Case, C.W.,** Regional and community impacts of the Department of Energy. Energy technology pilot program in the western Pacific, 6:21932
**Case, G.N.,** *See* McDowell, W.J., 6:22516
**Casperson, D.E.,** Optical diagnostics of $CO_2$ laser-fusion targets using backscattered light, 6:22881 (LA-UR—81-1435)
**Cassano, A.A.,** *See* Tsao, T.R., 6:21512
**Cassel, J.F.,** *See* Voorhees, L.D., 6:22721
**Casson, L.M.,** *See* Lester, M.I., 6:22397
**Castle, R.N.,** *See* Lee, M.L., 6:21501
*See* Willey, C., 6:21537
**Cecchi, J.L.,** *See* Dylla, H.F., 6:22929
**Cecelski, E.,** *See* Koshel, P., 6:22167
**Celati, R.,** *See* Schroeder, R.C., 6:21968
**Ceyzeriat, P.,** *See* Buchet, J.P., 6:22764
**Chabannes, G.,** *See* Wysocki, M.D., 6:21919
**Chae, D.G.,** *See* Lee, Y.S., 6:22867
**Chaklos, J.T.,** *See* Balko, E.N., 6:22308
**Chamberlain, D.B.,** *See* Gombert, D. II, 6:21671
**Chambers, W.F.,** Digitally controlled x-ray mapping, 6:22337 (SAND—81-0331C)
**Chan, F.T.,** *See* Lieber, M., 6:22773
**Chan, S.M.,** *See* Lehtomaki, N.A., 6:22022
**Chan, S.T.,** *See* Sani, R.L., 6:22445
**Chan, S.T.K.,** *See* Gresho, P.M., 6:22444
**Chanana, A.D.,** *See* Chandra, P., 6:22634
**Chandra, P.,** Distribution of T and B lymphocytes in blood and lymphoid tissues of fetal and adult sheep, 6:22634
**Chang, C.K.,** *See* Netzel, T.L., 6:22626
**Chang, S.G.,** *See* Gundel, L.A., 6:22532
*See* Oblath, S.B., 6:22366
**Chang, Y.K.,** *See* Young, R.T., 6:21759
**Changelian, G.P.,** Synopsis of interim final report. conceptual design of a coal-to-methanol commercial plant, 6:21733
**Chao, A.W.,** *See* Donald, M.H.R., 6:22470
*See* Lee, M.J., 6:22472
**Chartier, V.L.,** Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:22015
**Chastain, C.J.,** Action of protein synthesis inhibitors in blocking electrogenic $H^+$ efflux from corn roots, 6:22663
**Chattopadhyay, S.,** Photoelectron spectroscopy of carbonyls: saturated normal dicarboxylic acids, 6:22382
**Chau Wang, L.L.,** Is Yang-Mills equation a totally integrable system. Lecture III, 6:22834 (BNL—29546)
**Cheek, G.,** MIS silicon solar cells: potential advantages, 6:21793 (SERI/TP—612-1190)
**Chen, C.K.,** Intuitive approach to a generalized parton picture for high-energy lepton—hadron scattering, 6:22831
**Chen, E.P.,** Transient stress analysis of high-energy gas-fracture experiments, 6:21604 (SAND—81-0703)
**Chen, F.F.,** *See* Turechek, J.J., 6:22896
**Chen, H.,** Laser induced fluorescence studies of UII produced by photoionization of uranium, 6:22799
**Chen, T.H.,** Two-phase velocity and density in finite pipes by intrusive and nonintrusive instrumentation, 6:22074 (EGG-M—00881)
**Cheng, C.Z.,** *See* Okuda, H., 6:22890
**Cheng, K.T.,** Atomic structure calculations using the relativistic random phase approximation, 6:22755 (ANL—80-126, pp 115-132)
**Cheng, R.K.,** Experimental study of the flowfield of a V-shaped premixed turbulent flame, 6:22415 (LBL—12141)
Strong ignition limits for methane-hydrogen mixtures, 6:21727 (LBL—12146)
**Chianelli, R.R.,** *See* Rabitz, S.H., 6:21581
**Chiang, J.,** *See* Bedair, S.M., 6:21802
**Chiang, S.H.,** *See* Jones, G. II, 6:21809
**Chiles, M.M.,** *See* Ragan, G.L., 6:21646
**Chitre, S.,** Feasibility study of a microwave application for solar-cell fabrication. Annual report for period ending February, 1981, 6:21781 (SERI/PR—8041-16-T1)
**Cho, B.K.,** Continuous chromatographic reactor, 6:22361
**Choat, E.E.,** UCC-ND engineering program, 6:22171 (CONF-8003114—, pp 75-83)
**Chong, C.Y.,** Statistical synthesis of power system functional load models, 6:22019
**Chong, S.L.,** Alkanes obtained by thermal conversion of Green River oil-shale kerogen using CO and H/sub 2/O at elevated pressure, 6:21614
**Chou, T.S.,** Pumping behavior of sputter ion pumps, 6:22453
*See* Foerster, C.L., 6:22507
**Chowdhuri, P.,** Wave propagation in a dc superconducting cable--1. Analysis, 6:22014
**Christensen, C.,** *See* Place, W., 6:21921
**Christensen, E.L.,** *See* Shipley, J.P., 6:21714
**Christensen, J.J.,** Separation of alkali, alkaline earth and rare earth cations by liquid membranes containing macrocyclic carriers. Third progress report, September 1, 1980-April 1, 1981, 6:22326 (DOE/ER/05016—3)
**Christie, N.T.,** Evidence for nonrandom alterations in a fraction of the highly repetitive DNA of a eukaryote, 6:22639
**Christie, W.H.,** *See* Lowndes, D.H., 6:21760
**Christner, L.,** Technology development for phosphoric acid fuel cell powerplant (Phase II): 7th quarterly report, 6:22162 (DOE/NASA/0067—79-6)
**Christoffersen, R.E.,** Electronic structural properties and photosynthesis, 6:21810
**Chu, W.T.,** *See* Alonso, J.R., 6:22491
**Churukian, C.J.,** *See* Moosavi, H., 6:22646
**Clark, G.,** Comfort conditions in roof pond cooled residences without air conditioners, 6:21911
*See* Haves, P., 6:21886
*See* Manning, R., 6:21888
**Clark, G.L.,** Generic methods for design of small-bore pipe supports, 6:22060 (HEDL-SA—2275-FP)
**Clark, J.B.,** Use of microorganisms in enhanced oil recovery, 6:21569 (DOE/BC/10300—10)
**Clark, J.P.,** *See* Flemings, M.C., 6:22267
**Clark, R.P.,** Implementation plan (May 1979): batteries for specific solar applications, 6:21773 (SAND—80-0216)
**Clauer, A.H.,** *See* Wright, I.G., 6:21497
**Cleland, J.W.,** *See* Lowndes, D.H., 6:21760
**Cleland, R.E.,** *See* Stevenson, T.T., 6:22662
**Clem, J.R.,** Time-dependent voltage generated by flux motion across a superconducting strip, 6:22865
**Clem, M.F.,** *See* Snipes, M.B., 6:22706
**Clements, J.S.,** *See* Liepins, R., 6:22941
**Clendenin, J.E.,** Single bunch beam measurements for the proposed SLAC linear collider, 6:22500 (SLAC-PUB—2698)
**Clesceri, L.S.,** Modeling the environmental fate of synthetic organic chemicals, 6:22590
**Cleveland, B.T.,** Solar neutrino experiments and neutrino oscillations, 6:22736 (BNL—29440)
**Cline, K.,** Host-pathogen interactions. XV. Fungal glucans which elicit phytoalexin accumulation in soybean also elicit the accumulation of phytoalexins in other plants, 6:22649
**Clinton, J.H.,** *See* Garg, D., 6:21499, 6:21500
**Close, E.,** Numerical simulation of the transport of intense beams of heavy ions in an electrostatic quadrupole system, 6:22473 (SLAC-PUB—2673)
**Clynch, J.R.,** *See* Fitzgerald, T.J., 6:22743
**Cobb, D.D.,** *See* Hakkila, E.A., 6:21715
**Coffelt, E.L.,** *See* Elliott, C.J., 6:22914
**Coffield, R.D.,** Natural convection analyses and verification for LMFBR cores, 6:22030
**Cohen, A.D.,** Peat resources of South Carolina, 6:21550
**Cohen, R.,** Electric power generation: ocean thermal energy conversion, 6:21844
**Cohen, S.,** *See* Forster, J.D., 6:21649
**Cohen, S.A.,** *See* Wu, C.H., 6:22926
**Cohen, S.M.,** Comparison of $^{13}C$ nuclear magnetic resonance and $^{14}C$ tracer studies of hepatic metabolism, 6:22613
**Cohn, E.,** *See* Harding, C.V., 6:22669
**Colberg, P.J.,** Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980, 6:21729 (SERI/TR—98174-1)
**Cole, M.W.,** *See* Goles, R.W., 6:22342
**Cole, R.J.,** *See* Sawyer, C.H., 6:22212
**Colemen, J.J.,** *See* Zehr, S.W., 6:21801
**Coles, D.G.,** *See* Shultz-McKinley, S., 6:21686
*See* Tewhey, J.D., 6:21654
**Colgate, S.A.,** Galactic origin of cosmic rays I, 6:22739 (LA-UR—81-965)
Galactic origin of cosmic rays II, 6:22740 (LA-UR—81-966)
**Colleraine, A.P.,** *See* Otavka, M.A., 6:22932
**Collier, R.K.,** *See* Arnold, F.H., 6:21887
**Collier, R.P.,** *See* Bishop, T.A., 6:22067
*See* Liu, J.S.K., 6:22084
**Collins, D.R.,** *See* Fincke, J.R., 6:22071
**Collins, L.H.,** *See* Zook, A.C., 6:22357
**Collins, M.T.,** *See* Sandorfi, A.M., 6:22848
**Colton, E.L.,** *See* Gombert, D. II, 6:21671
**Combs, C.,** *See* Swann, T., 6:22913

**Combs, L.P.,** Rockwell international gasifier--flash hydropyrolysis, 6:21523
**Comly, J.C. Jr.,** *See* Goldstein, J.C., 6:22434
**Cong, K.T.,** *See* Buchet, J.P., 6:22764
**Connolly, J.M.,** Computer modeling of thermal storage walls, 6:21929
*See* Ortega, J.K.E., 6:21845
**Connor, L.T.,** *See* Yarosh, M.M., 6:21756
**Constant, T.,** *See* Smith, H., 6:22494
**Converse, A.O.,** *See* Hall-Martindale, M., 6:21918
**Conway, J.G.,** *See* Worden, E.F., 6:22811
**Cook, E.G.,** Subnanosecond trigger system for ETA, 6:22457 (UCRL—83992)
**Cook, J.R.,** Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
*See* Thayer, P.A., 6:21637
**Cooper, M.D.,** *See* Butler, H.S., 6:22486
**Cooper, R.E.,** *See* Pepper, D.W., 6:22543
**Cooper, S.R.,** *See* Raymond, K.N., 6:22698
**Coquereaux, R.,** Fermionic expansion in quantum electrodynamics, 6:22837
**Corbett, B.L.,** High flux isotope reactor quarterly report, July, August, and September of 1980, 6:22065 (ORNL/TM—7819)
**Corbin, L.T.,** Technical support, 6:22333 (ORNL—5738, pp 41-53)
**Corley, J.H.,** Energy management and control system, Y-12 Plant, 6:22172 (CONF-8003114—, pp 251-259)
**Cornwell, J.,** *See* Lesso, W.G., 6:21966
**Corry, W.D.,** Modification of erythrocyte physicochemical properties by millimolar concentrations of glutaraldehyde, 6:22718
**Corvinum, D.,** *See* Cohen, A.D., 6:21550
**Cosper, M.B.,** *See* Walker, R.D. Jr., 6:21578
**Costello, D.,** Technological and economic development of photovoltaics, 6:21806
**Costogue, E.N.,** Overview of photovoltaic collector technology status and objectives, 6:21800
*See* Ferber, R.R., 6:21834
**Couch, D.B.,** *See* Hsie, A.W., 6:22715
**Coulter, B.P.,** *See* Taylor, J., 6:22619
**Coulter, D.R.,** *See* Lester, M.I., 6:22397
**Cowan, M.,** Pulsed power for electromagnetic launching, 6:22426 (SAND—80-1987)
**Cowder, L.R.,** Gamma ray NDA assay system for total plutonium and isotopics in plutonium product solutions, 6:21712
**Cowgill, D.F.,** *See* Walko, R.J., 6:21721
**Cox, C.H.,** *See* Hendrie, S.D., 6:21940
**Cox, P.T.,** Precise measurement of the $J^0$ magnetic moment, 6:22818
*See* Wilkinson, C., 6:22821
**Craft, B.D.,** *See* Hudgens, C.R., 6:22354
**Craig, J.H. Jr.,** Gas release studies from explosion-cladded materials, 6:22922
**Cramer, M.A.,** Performance of solar energy hot water systems, 6:21868 (SOLAR/0005—81/80, pp 15-24)
**Cramer, S.P.,** *See* Scott, R.A., 6:22390
**Crandall, R.S.,** *See* Carlson, D.E., 6:21791
**Crane, J.K.,** *See* Hendricks, C.D., 6:21720
**Crane, R.E.,** Technical and financial aspects of electric utility peak load reduction through solar space heating system controls, 6:21931
**Crawford, R.B.,** *See* Weissenberger, S., 6:22920
**Crawley, R.L.,** In situ seeding of high Z elements with glow discharge polymerized organic coatings, 6:22944
**Creel, L.R.,** PLOT2K: a graphics interface to System 2000, 6:22975 (LA-UR—81-1192)
**Crews, R.,** *See* Farhar, B.C., 6:22103
*See* Unseld, C.T., 6:21754
**Cripe, A.,** *See* Loxsom, F.M., 6:21930
**Criswell, T.L.,** *See* Alonso, J.R., 6:22491
**Crook, K.,** *See* Smith, H., 6:22494
**Crosby, F.,** *See* Fugitt, J., 6:22488
**Croucher, D.W.,** Three Mile Island Unit-2 core status summary: a basis for tool development for reactor disassembly and defueling, 6:22076 (GEND—007)
**Crow, W.D.,** *See* Adler, H.I., 6:22648
**Crowe, K.M.,** *See* Bistirlich, J.A., 6:22847
*See* Fleming, D.G., 6:22380
*See* Martoff, C.J., 6:22849
**Crowley, J.L.,** *See* Jonath, A.D., 6:21789
**Cuellar, E.,** Combustion diagnostics by tunable atomic line molecular spectroscopy, 6:22364 (LBL—12127)
**Cumalat, J.P.,** *See* Russell, J.J., 6:22820
**Cummings, R.D.,** Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis. Final report, 6:21667 (DOE/TIC—1021731)
Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis, 6:21668 (DOE/TIC—1022080)
**Cummings, R.G.,** *See* Burness, H.S., 6:22109
**Cummins, J.J.,** *See* Chong, S.L., 6:21614
**Cunningham, G.W. III.,** *See* Vondy, D.R., 6:22038
**Cunningham, M.E.,** *See* Olsen, A.R., 6:22068
**Cunningham, M.J.,** *See* Carroll, R.D., 6:22728
**Curran, G.P.,** *See* Sudbury, J.D., 6:21534
**Curry, W.H.,** Utilization of hybrid computational equipment for the simulation of parachute system flight, 6:22427 (SAND—80-2549C)
**Curtis, B.,** *See* Place, W., 6:21921
**Curtis, C.W.,** *See* Garg, D., 6:21499, 6:21500
**Curtis, L.J.,** Cancellations in atomic dipole transition moments in the Cu isoelectronic sequence, 6:22346
**Cusimano, J.P.,** *See* Bush, W.J., 6:22510
**Cverna, F.H.,** *See* Eccleston, G.W., 6:21690

## D

**D'Ambra, C.A.,** *See* Northrop, G.M., 6:21542
**D'Amico, V.J.,** DOE's in-house energy management program, 6:22113 (CONF-8003114—, pp 19-26)
**D'Silva, A.P.,** *See* Yang, Y., 6:22345
**Dai, H.L.,** Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)
**Daniels, E.J.,** *See* Donakowski, T.D., 6:21510
**Danyluk, S.,** *See* Arnold, J.M., 6:21489
**Das, G.,** Quadratically convergent MCSCF theory for large configuration sets, 6:22778 (LBL—12157, pp 10-13)
**Das, S.K.,** Deuterium and helium ion irradiation effects on $TiB_2$ coatings, 6:22960
**Dashen, R.,** Relationship between lattice and continuum definitions of the gauge-theory coupling, 6:22840
**Davidson, V.,** *See* Nowak, J., 6:22502
**Davis, D.,** *See* Jaenke, R.S., 6:22691
**Davis, H.L.,** *See* Zehner, D.M., 6:22324
**Davis, J.,** Maine peat resource evaluation program, 6:21551
**Davis, J.W.,** *See* Wille, G.W., 6:22270
**Davis, R. Jr.,** *See* Cleveland, B.T., 6:22736
**Davis, R.B.,** Data summary report for the destructive examination of Rods G7, G9, J8, I9, and H6 from Turkey Point Fuel Assembly B17, 6:22027 (HEDL-TME—80-85)
*See* Kasper, J.V.V., 6:21835
**Davis, W.C.,** Detonation pressures of PBX-9404, composition B, PBX-9502, and nitromethane, 6:22523 (LA-UR—81-1067)
**Davitian, H.,** Economics of electric utility backup for solar heating and hot water, 6:21748
**Daw, C.S.,** *See* Holcomb, R.S., 6:21992
**Day, R.D.,** Antares alignment gimbal positioner, 6:22915 (LA-UR—81-1394)
**Dayem, H.A.,** *See* Hakkila, E.A., 6:21715
*See* Thomas, C.C. Jr., 6:21694
**De Boer, F.W.N.,** *See* Fields, C.A., 6:22845
**De Jonghe, L.C.,** Failure modes of Na-beta alumina, 6:22091 (LBL—12445)
**de Leeuw, S.W.,** *See* Kalia, R.K., 6:22862
**de Montmollin, J.M.,** Goals of measurement systems for international safeguards, 6:21713
**de Vellis, J.,** *See* McGinnis, J.F., 6:22617
**Deadrick, J.,** *See* Hawke, R.S., 6:22429
**Dean, E.M.,** *See* Singer, R.M., 6:22063
**Dean, F.F.,** *See* Winblad, A.E., 6:21650
**DeAngelis, D.L.,** Implications of a partial-differential-equation cohort model, 6:22610
**DeAngelis, M.,** Conventional HVAC contractors: convincing the competition to join the solar movement, 6:21755
Design and installation considerations for refrigerant charged thermosyphoning solar DHW systems, 6:21917
**DeBlasio, R.,** *See* Ross, R., 6:21831
**Debs, A.S.,** *See* Chong, C.Y., 6:22019
**deCampo, R.,** *See* Aronson, S.J., 6:21849
**Decher, U.,** Evaluation and demonstration of methods for improved nuclear-fuel utilization. First semi-annual progress report, inception to June 30, 1980, 6:22046 (DOE/ET/34013—T1)
**Deck, L.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Degens, E.T.,** Rate of denudation in Black Sea source area, 6:22561 (CONF-8009140—, pp 34-45)
**deGrassie, J.S.,** Titanium gettering in Doublet III, 6:22927
**Deininger, W.D.,** Infrared techniques for the evaluation of silicon carbide heat-exchanger tubing, 6:22447

**Deiss, S.R.,** Applicability of the FASTBUS standard to distributed control, 6:22503 (SLAC-PUB—2703)
**DeJonghe, L.,** *See* Cairns, E., 6:22092
**deKieffer, R.,** *See* Baccei, B., 6:21900
**DeLafosse, P.H.,** *See* Tibbets, G.A., 6:21973
**DeLuca, N.,** Early events in herpes simplex virus type 1 infection: photosensitivity of fluorescein isothiocyanate-treated virions, 6:22652
**Denis, A.,** *See* Buchet, J.P., 6:22764
**Derencsenyi, T.T.,** Phosphorus-31 nuclear magnetic resonance as a method of predicting ligand basicity and rates of homogeneous catalysis, 6:22387
**Dermendjiev, E.,** *See* Lee, D.M., 6:21716
**Desclaux, J.P.,** State-of-the-art for multiconfiguration Dirac-Fock calculations, 6:22753 (ANL—80-126, pp 78-93)
**DeSerio, F.,** Solar cities and towns program, 6:21893
**DeSerio, R.,** Recent results in $\Delta n = 0$, $n = 2$ transitions of helium-like systems, 6:22765 (ANL—80-126, pp 240-259)
**Desesquelles, J.,** *See* Buchet, J.P., 6:22764
**DeShazer, J.A.,** Solar space heating a growing-finishing swine building without added thermal storage, 6:21882
**Deslattes, R.D.,** Inner shell energies: experimental problems, 6:22763 (ANL—80-126, pp 215-235)
**Detch, J.L. Jr.,** *See* King, N.S.P., 6:22520
**Detrich, J.H.,** Calculations of relativistic effects in atoms and molecules from the Schroedinger wave function, 6:22752 (ANL—80-126, pp 69-77)
*See* Roothaan, C.C.J., 6:22783
**Deutscher, S.B.,** *See* Richardson, J.H., 6:21797
**Devary, J.L.,** Geostatistical modeling of pore velocity, 6:22725 (PNL-SA—9096)
**Devlin, T.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Dhalla, A.K.,** Simplified inelastic analysis procedure to evaluate a butt-welded elbow end, 6:22034 (CONF-810625—16)
*See* Karabin, M.E., 6:22033
**Diachok, D.,** International passive architectural survey: preliminary analysis, 6:21923
**Diamond, S.C.,** DOE-2 Verification Project. Phase I. Interim report, 6:22205 (LA—8295-MS)
**Dick, R.D.,** PHERMEX applications to study high-pressure flow and detonation waves, 6:22524 (LA-UR—81-1270)
**Dickinson, W.C.,** Industrial process heat, 6:21916
**Dickson, K.L.,** *See* Maki, A.W., 6:22582
**Dieball, J.W.,** *See* Pena, J.L., 6:22951
**Dietz, R.J.,** *See* Hakkila, E.A., 6:21715
*See* Shipley, J.P., 6:21714
**Dietz, T.G.,** Laser production of supersonic metal cluster beams, 6:22280
**Dillon, M.A.,** Analytic representation of the dipole oscillator-strength distribution, 6:22802
New, optically forbidden Rydberg series in $O_2$ converging to the $O^+_2$ c $^4S^-$/sub u/ limit, 6:22800
**Dilworth, M.F.,** Phycobilisome-thylakoid topography on photosynthetically active vesicles of Porphyridium cruentum, 6:22661
**Doak, L.,** Long-term performance trends for ten solar systems monitored by the national solar data network, 6:21869 (SOLAR/0005—81/80, pp 25-29)
**Doak, L.G.,** *See* Barvir, E.J., 6:21871
**Dobecki, T.L.,** Applications of reflection seismics to mapping coal-seam structure and discontinuities, 6:21546 (SAND—81-1069C)
**Doctor, P.G.,** The use of geostatistics in high level radioactive waste repository site characterization, 6:21688
*See* Devary, J.L., 6:22725
**Dod, R.L.,** *See* Gundel, L.A., 6:22532
*See* Novakov, T., 6:22546
**Doderer, E.,** *See* Loxsom, F.M., 6:21930
**Doe, T.,** Hydraulic fracturing and overcoring stress measurements in a deep borehole at the Stripa Test Mine, Sweden, 6:21673 (LBL—12478)
**Doherty, D.J.,** Preliminary geological interpretation and lithologic log of the exploratory geothermal test well (INEL-1), Idaho National Enginering Laboratory, eastern Snake River Plain, Idaho, 6:21962 (USGS-OFR—79-1248)
**Dolan, J.F.,** *See* Griffin, T.P., 6:21539
**Donakowski, T.D.,** Manpower requirements for an emerging energy technology: high-Btu coal gasification, 6:21510 (DOE/TIC—1021172)
**Donald, M.H.R.,** Some schemes for on-line correction of the closed orbit, dispersion and beta functions in PEP, 6:22470 (SLAC-PUB—2666)
**Donnelly, J.A.,** *See* Moosavi, H., 6:22646
**Donnelly, R.G.,** ORNL energy conservation management plan, 6:22170 (CONF-8003114—, pp 65-73)
**Dooley, D.F.,** Molecular beam studies of atomic hydrogen reduction of refractory oxides, 6:22275 (LBL—12548, pp 62-63)
**Dougher, R.,** *See* Koshel, P., 6:22167
**Dove, F.H.,** *See* Nelson, R.W., 6:21681
**Downing, R.W.,** *See* Deiss, S.R., 6:22503
**Downs, J.L.,** Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Downs, R.L.,** Analysis of glass shell blowing gases from metal-organic gels, 6:22948
*See* O'Holleran, T.P., 6:22949
**Doyle, B.L.,** Hydrogen retention and release in first-wall coatings for tokamaks, 6:22963
Nuclear microprobe analysis, 6:22787 (SAND—81-0203C)
**Dragonette, K.,** *See* Wheeler, M.L., 6:21672
**Drake, G.W.F.,** Application of discrete basis set methods to the Dirac equation, 6:22756 (ANL—80-126, pp 133-139)
**Drake, J.F.,** Irreversibility and transport in the lower hybrid drift instability, 6:22895
**Dresner, J.,** *See* Carlson, D.E., 6:21791
**Dressendorfer, P.V.,** *See* Ochoa, A. Jr., 6:22456
**Driscoll, M.J.,** MIT LMFBR blanket research project. Quarterly progress report, October 1, 1980-December 31, 1980, 6:22035 (DOE/ET/37241—45)
**Druetta, M.,** *See* Buchet, J.P., 6:22764
**Drummond, W.E.,** Design study for a high-current, steady-state auto-resonant accelerator. Addendum to final report, July 14, 1979-November 14, 1979, 6:22484 (DOE/ER/05911—T1)
**Drury, J.S.,** Uranium in US surface, ground, and domestic waters. Volume 2, 6:22595 (ORNL/EIS—192/V2)
Uranium in US surface, ground, and domestic waters, 6:22596 (ORNL/EIS—192/V4)
Uranium in US surface, ground, and domestic waters, 6:22597 (EPA—570/9-81-001(Vol.1))
**Drury, L.N.,** Solar poultry brooding research at the Southeast Poultry Research Laboratory: a progress report, 6:21883
**Dubach, J.,** Exchange current effects in magnetic electron scattering from $^{49}$Ti, $^{51}$V, $^{59}$Co, $^{87}$Sr, and $^{93}$Nb, 6:22850
**Dubester, L.,** Overcoming the non-technical barriers to the acceptance and utilization of passive solar energy through education and promotional activities, 6:21892
**Dubin, F.S.,** Do's and don't in energy conservation design, 6:22114 (CONF-8003114—, pp 29-44)
**Duchane, D.V.,** Polymeric mandrels: supersmooth finish by an infusion process, 6:22309
**Duffie, J.A.,** *See* Erbs, D.G., 6:21745
**Duk-In, C.,** *See* Horton, W. Jr., 6:22892
**Dukes, C.,** *See* Wilkinson, C., 6:22821
**Dumas, L.N.,** *See* Runkle, L.D., 6:21832
**Dumont, J.N.,** *See* Brummett, A.R., 6:22657
**Duncan, L.M.,** SPS ionosphere/microwave beam interactions: Arecibo experimental studies, 6:21752 (LA-UR—80-3095)
**Duncan, M.A.,** *See* Dietz, T.G., 6:22280
**Dunipace, D.,** *See* Rains, D., 6:21853
**Dunn, J.C.,** Two-dimensional temperature distribution surrounding an injection well, 6:21573 (SAND—81-0101C)
**Dupuis, M.,** Recent developments and applications of multi-configuration Hartree-Fock methods. NRCC proceedings No. 10, 6:22777 (LBL—12157)
Super-CI MCHF program in ALCHEMY, 6:22782 (LBL—12157, pp 71-72)
**Durbin, P.W.,** *See* Raymond, K.N., 6:22698
**Durham, W.B.,** Direct observation of explosively induced damage in sandstone with application to reservoir stimulation, 6:21605 (UCRL—85331(Rev.1))
**Dutton, E.J.,** Examination of some hypothetical SPS rectenna sites within the contiguous United States of America. Part I. Precipitation effects on hypothetical SPS sites in the USA. Part II. Point-to-point microwave and service mode communications systems near four hypothetical SPS rectenna sites in the continental United States, 6:21812 (DOE/ER/10160—T4)
**Dvoskin, D.,** *See* Heady, E.O., 6:22101
**Dworkin, J.,** *See* Cox, P.T., 6:22818

*See* Wilkinson, C., 6:22821
**Dylla, H.F.,** Effect of hydrogen glow discharge conditioning on Zr/Al getter pumps, 6:22929
*See* Ellefson, R.E., 6:22924

## E

**Eacret, K.M.,** Beamed daylighting: historical review, current testing and analysis and design options, 6:22214
**Eaton, B.E.,** *See* Sani, R.L., 6:22445
**Eaton, M.J.,** *See* Fehlau, P.E., 6:21709
**Eberhardt, L.E.,** *See* Penman, J.A., 6:22660
**Eberly, J.H.,** *See* Shore, B.W., 6:22789
**Ebner, M.A.,** *See* Downs, R.L., 6:22948
**Eby, R.E.,** *See* Lowndes, D.H., 6:21760
**Eccleston, G.W.,** Monte Carlo calculational design of an NDA instrument for the assay of waste products from high enriched uranium spent fuels, 6:21690
**Eckert, R.,** *See* Tang, A., 6:21490
**Ecklund, E.E.,** *See* Escher, W.J.D., 6:21725
**Edelman, R.B.,** *See* Kowalik, R.M., 6:21998
**Edelstein, N.M.,** Lanthanide and actinide chemistry and spectroscopy, 6:22376
**Edenburn, M.W.,** *See* Burns, J.R., 6:21775
**Edesess, M.,** *See* Jayadev, T.S., 6:21949
**Edeskuty, F.J.,** *See* Steward, W.F., 6:21724
**Edstrom, C.M.,** Fabricating tungsten crucibles by drawing and extrusion spinning, 6:22277 (RFP—3049)
**Edwards, D. Jr.,** Interrupted pumpdown of a vacuum system, 6:22455
Water vapor pressure gauge, 6:22451
**Edwards, D.F.,** Infrared refractive index of diamond, 6:22320
**Edwards, J.J.,** Two-dimensional electrophoretic mapping of human erythrocyte proteins, 6:22622
*See* Anderson, N.L., 6:22618
**Edwards, P.E.,** Energy conservation opportunities, 6:22174 (CONF-8003114—, pp 279-286)
**Ehsani, M.,** *See* Fuja, R.E., 6:22961
**Einstein, T.L.,** *See* Roelofs, L.D., 6:22287
**Elghobashi, S.E.,** Effect of solid particles on the turbulent flow of a round gaseous jet: a mathematical and experimental study. Quarterly technical progress report, January 1-April 30, 1981, 6:22441 (DOE/PC/30303—T2)
**Elie, C.M.,** *See* Stephens, L.C., 6:22677
**Ellefson, R.E.,** Hydrogen isotope analysis by quadrupole mass spectrometry, 6:22924
**Ellingson, R.G.,** Study of the global energy balance, 6:22533 (UCRL—85958)
**Elliott, C.J.,** In-situ optical breakdown: studies for a large $CO_2$ laser amplifier, 6:22914 (LA-UR—81-1245)
**Elwood, J.W.,** *See* O'Neill, R.V., 6:22611
**Elyashar, N.N.,** *See* Carlson, W.F., 6:22912
**Encinas, M.V.,** Triplet energy migration in polymer photochemistry. A model for the photodegradation of poly(phenyl vinyl ketone) in solution, 6:22403
**Endoh, Y.,** Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4$NMn/sub c/Cu/sub 1-c/$Cl_3$, 6:22319
**English, B.C.,** *See* Heady, E.O., 6:22101
**Ensminger, J.T.,** *See* Drury, J.S., 6:22595, 6:22596, 6:22597
**Epler, J.L.,** *See* Larimer, F.W., 6:22710
*See* Rao, T.K., 6:22713
**Erbs, D.G.,** Basis and effects of inaccuracies in diffuse radiation correlations, 6:21745
**Ermolaev, A.M.,** Are we ready to test QED in two-electron ions, 6:22757 (ANL—80-126, pp 140-148)
**Esch, G.W.,** *See* Hazen, T.C., 6:22659
**Escher, W.J.D.,** Hydrogen-via-Electricity concept. Critique report, 6:21725 (DOE/CE—0005)
**Escott, S.P.,** *See* Baird, J.K., 6:22813
**Esmay, M.,** *See* Hall, F., 6:21884
**Espenson, J.H.,** *See* Funke, L.A., 6:22388
**Esser, M.A.,** *See* Weissenberger, S., 6:22920
**Eubank, H.P.,** *See* Suckewer, S., 6:22886
**Eustis, R.H.,** High magnetic field MHD generator program. Final report, July 1, 1976-December 31, 1979, 6:22144 (DOE/ET/10780—T1)
**Eutsler, B.C.,** *See* McInroy, J.F., 6:22556
**Evans, A. Jr.,** Comparison of programming languages: Ada, Praxis, Pascal, C, 6:22980 (UCRL—15346)
**Evans, D.L.,** Simplified method for predicting photovoltaic array output, 6:21804
**Evans, J.,** *See* Cairns, E., 6:22092
**Evans, K.D.,** *See* Cramer, M.A., 6:21868
**Evans, T.L.,** On-site data acquisition system for photovoltaic applications experiments, 6:21823 (SAND—81-0897)
**Everhart, T.,** *See* Colberg, P.J., 6:21729
**Ewing, R.C.,** Radiation damage in natural materials: implications for radioactive waste forms, 6:21655 (CONF-8005107—, pp 81-99)
**Eyssa, Y.M.,** Force and inductance calculations for pulsed energy storage shielded magnets, 6:22085

## F

**Fabrikant, J.I.,** Bilogical effects of ionizing radiation: epidemiological surveys and laboratory animal experiments. Implications for risk evaluation and decision processes, 6:22694 (LBL—12555)
**Faddoul, J.R.,** Test evaluation of a laminated wood wind turbine blade concept, 6:21984 (DOE/NASA/20320—30)
**Faehl, R.J.,** *See* Shanahan, W.R., 6:22806
**Fahmideh-Vojdani, A.R.,** Economic dispatch with generation constraints, 6:22021
**Fajer, J.,** *See* Netzel, T.L., 6:22626
**Farabaugh, E.N.,** *See* Haller, W., 6:22305
**Farber, M.G.,** Design and operation of a prototype incinerator for beta-gamma waste, 6:21669 (DP-MS—80-123)
**Farhar, B.C.,** Public opinion about energy, 6:22103
*See* Unseld, C.T., 6:21754
**Farkas, Z.D.,** Superconducting cavities and modulated RF, 6:22496 (SLAC-PUB—2682)
**Farmer, R.C.,** *See* Kowalik, R.M., 6:21998
**Farnaam, M.,** Surface chemistry of epitaxial silicon deposition by thermal cracking of silane, 6:22313 (LBL—12548, pp 11-19)
**Farnham, R.S.,** Peatland reclamation - the energy crop option, 6:21553
**Farnum, E.,** Cleaning procedure for inertial fusion targets, 6:22936
**Farrell, M.P.,** n-dimensional pattern recognition in environmental systems, 6:22540 (CONF-801045—, pp 127-131)
**Fassbender, L.L.,** Economics of power plant district and process heating in Richland, Washington, 6:22255 (PNL—3719)
**Fassel, V.A.,** *See* Yang, Y., 6:22345
**Fee, D.C.,** *See* Johnson, C.E., 6:22055
**Fehlau, P.E.,** Passive nuclear material detection in a personnel portal, 6:21709
**Fehler, M.,** Acoustic radiation patterns for borehole sources, 6:21961 (LA-UR—81-1092)
**Feiner, M.,** *See* Volchok, H.L., 6:22331
**Feldman, B.J.,** Ultraviolet phase conjugation and its practical implications, 6:22435 (LA-UR—81-1565)
**Feldman, L.,** *See* De Jonghe, L.C., 6:22091
**Feldmann, D.,** *See* Lyman, J.L., 6:22339
**Felte, J.F.,** Application of penalty factors in procurement, 6:22233 (CONF-8003114—, pp 169-181)
**Feng-Ying, L.,** *See* Fu-Xi, G., 6:22863
**Fenimore, E.E.,** *See* Burek, A.J., 6:22742
**Ferber, R.R.,** Application potentials for flat plate and concentrator photovoltaic collectors, 6:21834
*See* Costogue, E.N., 6:21800
**Ferrell, T.L.,** *See* Becker, R.S., 6:22664
**Fields, C.A.,** Method for determining the neutron multiplicity for gamma rays from (particle,xnγ) reactions, 6:22845
**Filipy, R.E.,** *See* Busch, R.H., 6:22707
**Finch, C.B.,** *See* Abraham, M.M., 6:21656
**Fincke, J.R.,** Some factors affecting the metering of subcooled water with a choked venturi, 6:22071 (CONF-810406—4)
**Findley, G.L.,** *See* Chattopadhyay, S., 6:22382
**Findley, P.R.,** *See* Taylor, R.V., 6:22747
**Finnell, R.T.,** Description of the wind profile system developed for the PLACES test series, 6:22744 (SAND—81-0482)
Description of the barium cloud vectoring systems developed for the PLACES test series, 6:22745 (SAND—81-0483)
**Fireman, E.L.,** Carbon and carbon-14 in lunar soil 14163, 6:22737 (BNL—29527)
**Fischer, C.F.,** Correlation and relativistic effects in hole states, 6:22758 (ANL—80-126, pp 149-151)
**Fischer, O.,** *See* Thomlinson, W., 6:22317
**Fischer, W.H.,** *See* Billings, J.S., 6:22012
**Fisher, M.E.,** *See* Jones, G.L., 6:22875

**Fisher, R.A.,** *See* Feldman, B.J., 6:22435
**Fishman, S.,** *See* Jones, G.L., 6:22875
**Fitch, J.,** *See* Smith, H., 6:22494
**Fitzgerald, T.J.,** Occultation of the ATS-3 satellite by the AVEFRIA barium ion cloud, 6:22743 (CONF-810421—3)
**Flannery, M.R.,** Theoretical investigation and calculation of certain atomic and molecular processes important in the formation and destruction of excited stable gas molecules (or excimers). Final report, October 1, 1978-November 30, 1979, 6:22771 (DOE/DP/40017—T1)
**Flegal, C.,** *See* Hall, F., 6:21884
**Fleisig, H.,** Effect of OPEC oil pricing on output, prices, and exchange rates in the United States and other industrialized countries, 6:21588
**Fleissner, J.G.,** Study of a two-detector method for measuring plutonium isotopics, 6:21711
**Fleming, D.G.,** Muonium chemistry: a review, 6:22380
**Flemings, M.C.,** Assessment of the magnesium primary production technology. Final report, 6:22267 (DOE/CS/40284—T1)
**Fletcher, J.,** *See* Lowndes, D.H., 6:21760
**Fletcher, J.W.,** Performance of an experimental annual cycle solar regenerated desiccant crop dryer, 6:21880
**Fletcher, K.,** Analysis of cells isolated from bone cultured on collagen gels and polystyrene culture dishes, 6:22631 (UR—3490/LCP-22)
**Floran, R.J.,** Hot and cold pressing of $(La,Ce)PO_4$-based nuclear waste forms, 6:21658 (CONF-8005107—, pp 185-193)
*See* Abraham, M.M., 6:21656
**Flynn, G.W.,** *See* Lester, M.I., 6:22397
**Foerster, C.L.,** Evaluation of ISABELLE full cell ultrahigh vacuum system, 6:22507
Selection and evaluation of an ultrahigh vacuum gate valve for ISABELLE beam line vacuum system, 6:22450
**Foltyn, S.R.,** Laser damage testing of coated reflectors at excimer laser wavelengths, 6:22436 (LA-UR—81-1567)
**Forbes, N.L.,** *See* Hsie, A.W., 6:22715
**Force, R.,** *See* Lothrop, F., 6:22490
**Ford, A.,** Model simplification: a case study of end use demand modeling in the transportation sector, 6:22227 (LA-UR—81-813)
**Ford, C.D.,** Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Ford, P.C.,** *See* Bergkamp, M.A., 6:22384
**Ford, W.E. III,** Operating experience with LEAP from the perspective of the computing applications analyst, 6:22099 (ORNL/CSD/TM—141)
**Forster, J.D.,** Discount rate in the spent fuel storage and disposal fee, 6:21649 (ONWI—189)
**Fortenberry, J.W.,** Overview of the National Photovoltaics Program, 6:21799
**Fourney, W.L.,** Model studies of explosive well stimulation techniques, 6:21575
**Fournier, D.,** *See* Jackson, W.B., 6:22439
**Fowler, A.H.,** Energy, entropy, and information, 6:22096 (CONF-8003114—, pp 537-546)
**Fowler, C.M.,** *See* Hawke, R.S., 6:22429
**Fowler, J.,** *See* Wilems, R.E., 6:21678
**Fowler, T.B.,** *See* Vondy, D.R., 6:22038
**Fox, J.D.,** Luminosity monitor at PEP, 6:22499 (SLAC-PUB—2691)
**Fox, J.P.,** Retort abandonment: issues and research needs, 6:21617 (LBL—11197)
Wastewater treatment in the oil-shale industry, 6:21615 (LBL—11214)
**Frampton, P.H.,** Grand unification in N = 8 extended supergravity, 6:22833
**Frankel, R.,** RELWAY: a process data highway system optimized for accelerators, 6:22481 (BNL—29243)
**Franklin, M.E.B.,** *See* Fox, J.D., 6:22499
**Franta, G.E.,** Passive systems, physics, socio-economics, solar radiation, wind power, 6:21740
**Fraser, H.L.,** Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
**Frazzini, T.L.,** *See* Holland, M.K., 6:22353
**Frederickson, P.O.,** *See* Bucher, I.Y., 6:22974
**Freed, K.F.,** *See* Oono, Y., 6:22804
**Freeman, B.P.,** Automated ion-exchange system for the rapid separation of plutonium from impurities in safeguards analyses, 6:22359
**Freese, J.M.,** *See* Bergeron, K.D., 6:21948
**Freiser, H.,** *See* Tochiyama, O., 6:22344
**Freyman, R.W.,** Measurements of long delayed radio echoes in the auroral zone, 6:22746
**Friedland, L.,** Electron-cyclotron resonance heating in plasmas with arbitrary stratification of the magnetic field, 6:22893
**Friedlander, E.M.,** *See* Myers, W.D., 6:22844
**Friedman, J.,** *See* Combs, L.P., 6:21523
*See* Sprouse, K.M., 6:21519
**Fries, R.J.,** *See* Liepins, R., 6:22941
**Frome, E.L.,** General statistical data structure for epidemiologic studies of DOE workers, 6:22671 (CONF-801045—, pp 206-218)
*See* Polednak, A.P., 6:22695
**Frost, J.K.,** *See* Ruch, R.R., 6:21538
**Fu-Xi, G.,** Nonlinear refractive index $N_2$ of transparent dielectric crystals, 6:22863 (UCRL-Trans—11663)
**Fugitt, J.,** Simplified RF power system for Wideroe-type linacs, 6:22488 (LBL—11713)
**Fuja, R.E.,** Three phase energy transfer circuit with superconducting energy storage coils, 6:22961
**Fujita, I.,** *See* Netzel, T.L., 6:22626
**Fukuda, R.C.,** *See* Goles, R.W., 6:22342
**Fukuda, T.,** *See* Cowder, L.R., 6:21712
**Funabashi, K.,** *See* Encinas, M.V., 6:22403
**Fung, S.Y.,** *See* Lu, J.J., 6:22819
**Funk, J.J.,** *See* Walker, R.D. Jr., 6:21578
**Funke, L.A.,** Organochromium(III) complexes derived from nitriles, 6:22388
**Furth, H.P.,** Compact torus, 6:22903

## G

**Gadgil, A.,** Natural convection in room geometries, 6:21920
**Gaffney, J.,** Soot reduction in diesel engines: a chemical approach, 6:22260
**Gaines, I.,** *See* Russell, J.J., 6:22820
**Galanis, S.P. Jr.,** *See* Sass, J.H., 6:21964
**Galbraith, H.W.,** *See* Ackerhalt, J.R., 6:22775
**Galiana, F.D.,** *See* Fahmideh-Vojdani, A.R., 6:22021
**Gambill, D.T.,** *See* Aldrich, M.J., 6:21956
**Gantt, E.,** *See* Dilworth, M.F., 6:22661
**Garcia, J.,** *See* deGrassie, J.S., 6:22927
**Gardiner, D.A.,** 1979 DOE statistical symposium, 6:21619 (CONF-791016—)
**Gardjito,** *See* Hall, F., 6:21884
**Garg, D.,** Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, December 1, 1979-February 29, 1980, 6:21500 (DOE/ET/14806—T3)
**Garner, C.M.,** Interdigitated back contact solar cell with high-current collection, 6:21774 (SAND—80-2206C)
**Garner, D.M.,** *See* Fleming, D.G., 6:22380
**Garnier, J.E.,** Photovoltaics, 6:21772 (PNL-SA—9464)
**Garrison, J.,** *See* Shultz-McKinley, S., 6:21686
**Garrott, R.A.,** *See* Penman, J.A., 6:22660
**Garsd, A.,** Prediction of skeletal mass in growing and adult beagles, 6:22656
**Gartling, D.K.,** Finite element model for heat conduction in jointed rock masses, 6:21684 (SAND—80-2016)
**Garvey, D.B.,** In pursuit of clean air: a data book of problems and strategies at the state level. Supplement, 6:22535 (ANL/EES-TM—129)
**Gasner, S.,** *See* Ross, R., 6:21831
**Gehrs, C.W.,** *See* Aurbach, S.I., 6:22551
**Gel'perin, N.I.,** Membrane separation of a $CO_2$-$N_2$ mixture using steam, 6:22360
**Geller, D.,** *See* Alonso, J.R., 6:22491
**Genova, L.,** *See* Nowak, J., 6:22502
**Geronov, Y.,** Electrochemical studies of the film formation on lithium in propylene carbonate solutions under open circuit conditions, 6:22090 (LBL—12102)
**Gershowitz, H.,** *See* Williams, R.C., 6:22667, 6:22668
**Gertz, K.A.,** Reliability studies of materials using several LSI-11 based systems, 6:22448 (UCRL—85254)
**Gervasio, C.,** *See* Barvir, E.J., 6:21871
*See* Doak, L., 6:21869
**Ghaffari, H.T.,** Ground coupling and single-blow thermal storage in a double-envelope house, 6:22169 (BNL—29480)
**Ghiorso, M.S.,** Regular solution model for met-aluminous silicate liquids: applications to geothermometry, immiscibility, and the source regions of basic magmas, 6:22735
**Gibb, F.R.,** *See* Morrow, P.E., 6:22716

**Gibson, N.S.,** Project planning and design for energy conservation, 6:22219
**Gifford, M.,** *See* Hagerty, J.J., 6:21770
**Gilbert, P.A.,** Biodegradation tests: use and value, 6:22362
**Gilette, J.L.,** *See* Singer, R.M., 6:22063
**Gilkey, K.B.,** *See* Martner, B.E., 6:21982
**Gillespie, L.K.,** Effect of workpiece edge angle on radius produced by vibratory finishing, 6:22417 (BDX—613-2620)
**Gillette, D.,** *See* Edwards, D. Jr., 6:22451
**Ginley, D.S.,** *See* Butler, M.A., 6:21798
**Giometti, C.S.,** Two-dimensional electrophoresis of human saliva, 6:22623
*See* Anderson, N.L., 6:22618
**Givens, E.N.,** *See* Garg, D., 6:21499, 6:21500
*See* Ying, D.H.S., 6:21498
**Gladding, G.,** *See* Russell, J.J., 6:22820
**Glenn, B.H.,** *See* Franta, G.E., 6:21740
**Glowienka, J.C.,** ELMO Bumpy Torus: An alternate concept to tokamaks and mirrors, 6:22904
**Goetschel, D.V.,** *See* Kalita, J.K., 6:22988
**Goh, K.M.,** *See* O'Brien, B.J., 6:22555
**Golbeck, J.H.,** Redox titration of electron acceptor Q and the plastoquinone pool in Photosystem II, 6:22629
**Goldberg, I.B.,** Studies of the mechanism of coal hydrogenation by electron spin resonance. Quarterly technical progress report No. 4, 1 September 1980-31 November 1980, 6:21503 (DOE/PC/30072—T3)
**Goldberg, J.N.,** *See* Sudarshan, E.C.G., 6:22870
**Goldman, A.M.,** *See* Rao, N.A.H.K., 6:22291
**Goldman, H.,** *See* Wolf, M., 6:21767
**Goldman, L.M.,** Economic impact of a laser-fusion breeder on the U.S. energy economy, 6:22910
**Goldman, M.,** *See* Garsd, A., 6:22656
**Goldstein, B.,** *See* Carlson, D.E., 6:21791
**Goldstein, C.I.,** Finite element method with nonuniform mesh sizes for unbounded domains, 6:22986
**Goldstein, J.C.,** Small-signal-gain spectrum of an 1800 Torr $CO_2$ amplifier, 6:22434 (LA-UR—81-1232)
**Goldstein, M.,** *See* Stewart, L., 6:22120
**Goldston, R.J.,** *See* Suckewer, S., 6:22886
**Goldstone, L.A.,** *See* White, D.H., 6:21955
**Goles, R.W.,** Detection of iodine-129 by laser-induced fluorescence spectrometry, 6:22342
**Gombert, D. II,** Design and installation of a pilot-plant to vitrify ICPP-simulated calcined high-level waste, 6:21671 (ENICO—1087)
**Gomez, L.S.,** Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)
**Gonzalez, C.C.,** Performance measurement reference conditions for terrestrial photovoltaics, 6:21836
*See* Ross, R.G., 6:21830
**Goodman, M.C.,** *See* Russell, J.J., 6:22820
**Gordon, A.J.,** *See* Hoover, D.L., 6:22722
**Gordon, D.M.,** International safeguards at the feed and withdrawal area of a gas centrifuge uranium enrichment plant, 6:21699
**Gordon, H.T.,** Strategies for the use of passive solar approaches in commercial buildings, 6:21896
**Gordon, R.J.,** Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)
**Goris, P.,** Accountability study for TMI-2 fuel, 6:22026 (GEND—016)
Experimental u-233 nondestructive assay with a random driver, 6:22351
**Gormley, M.,** *See* Russell, J.J., 6:22820
**Gorn, W.,** *See* Lu, J.J., 6:22819
**Gornik, W.,** *See* Zavelovich, J., 6:22795
**Gottschalk, G.P.,** Integrated quality status and inventory tracking system for fftf driver fuel pins, 6:22064
**Gough, R.A.,** Use of a small off-line computer in the operation of a versatile heavy ion cyclotron, 6:22487 (LBL—11709)
**Granato, A.V.,** *See* Hultman, K.L., 6:22268
**Graves, T.,** *See* Brooks, S.O., 6:22248
**Gray, H.B.,** *See* Scott, R.A., 6:22390
**Gray, J.,** Tracking instrument and control for solar concentrators. Final technical report, October 1979-January 1981, 6:21941 (DOE/ET/21109—T1)
**Gray, R.W.,** Commercialization of coal gasification, liquefaction, and conversion to electricity, 6:21524
**Gray, W.J.,** Volatility of some potential high-level radioactive waste forms, 6:21666
**Green, D.W.,** Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species, 6:21645
Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species, 6:22410
**Green, M.,** *See* Stein, R.G., 6:22190
**Green, S.J.,** *See* Tibbets, G.A., 6:21973
**Greene, E.F.,** Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Greene, M.I.,** *See* Combs, L.P., 6:21523
**Greenman, P.,** Geometrical vector flux sinks and ideal flux concentrators, 6:21950
**Gregory, J.W.,** Building infiltration, 6:22176 (CONF-8003114—, pp 345-353)
**Gregory, P.E.,** InP single-junction concentrator cell. Semi-annual report, October 1, 1980-March 31, 1981, 6:21790 (SERI/PR—9354-T1)
**Gresho, P.M.,** Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems, 6:22446 (UCRL—85366)
Solution of the time-dependent, three-dimensional incompressible Navier-Stokes equations via FEM, 6:22444 (UCRL—85337)
*See* Sani, R.L., 6:22445
**Griest, W.H.,** *See* Herbes, S.E., 6:22584
**Griffin, P.M.,** *See* Hughes, R.H., 6:22807
**Griffin, T.P.,** Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)
**Griffith, J.M.,** Identification of multivariate linear systems, 6:22971 (CONF-810406—5)
**Griffiths, S.K.,** Size distribution of LLNL coarse fill, 6:22463 (UCID—18286)
**Grilly, E.R.,** *See* Bistirlich, J.A., 6:22847
**Grisham, D.L.,** Torus sector handling system, 6:22485 (LA-UR—81-1324)
**Grobel, R.,** *See* Cox, P.T., 6:22818
**Gross, D.J.,** *See* Dashen, R., 6:22840
**Grossman, B.L.,** *See* Solman, F.J., 6:21818
**Group, T.D.I.,** *See* deGrassie, J.S., 6:22927
**Group, T.J.,** *See* deGrassie, J.S., 6:22927
**Gruen, D.,** *See* Steinbruechel, C., 6:22285
**Gruen, D.M.,** *See* Pellin, M.J., 6:22803
**Gruhl, J.,** Strategies for model evaluation, 6:22098 (CONF-791016—, pp 146-153)
**Grund, C.E.,** *See* Lehtomaki, N.A., 6:22022
**Grunder, H.,** *See* Lothrop, F., 6:22490
**Grundy, R.R.,** Developing community networking utilizing the first weekly solar energy radio program, 6:21757
**Guenther, S.,** *See* Brooks, S.O., 6:22248
**Guerin, M.R.,** Bio/organic analysis section, 6:22334 (ORNL—5738, pp 55-80)
**Guin, J.A.,** *See* Garg, D., 6:21499, 6:21500
**Guiragossian, Z.G.T.,** Method of active charge and current neutralization of intense ion beams for ICF, 6:22917 (LA-UR—81-1408)
**Gundel, L.A.,** Role of black carbon in the organic chemistry of atmospheric aerosols, 6:22532 (LBL—12540)
*See* Novakov, T., 6:22546
**Gunkel, W.W.,** Wind driven direct water heating system development and field testing, 6:21989
**Gupta, A.,** *See* Laue, E.G., 6:21742
**Gupta, V.P.,** *See* Bush, W.J., 6:22510
**Gurira, R.C.,** Electroanalytical chemistry of (carbon monoxy)heme, 6:22392
**Gustavson, D.B.,** *See* Deiss, S.R., 6:22503
**Gutacker, A.R.,** *See* Farnum, E., 6:22936
**Gutmacher, R.G.,** *See* Thomas, C.C. Jr., 6:21694

## H

**Habegger, L.S.,** *See* Wolsko, T., 6:21811
**Hadden, C.T.,** Measurement of pyrimidine dimers in spheroplasts of Bacillus subtilis, 6:22701
**Hagerty, J.J.,** Process development for automated solar-cell and module production. Task 4. Automated array assembly. Quarterly report No. 3, 6:21770 (DOE/JPL/955699—81/03)
**Haggmark, L.G.,** *See* Wilson, K.L., 6:22956
**Haglund, R.F. Jr.,** Temporal shaping of nanosecond $CO_2$ laser pulses in multiphoton saturable absorbers, 6:22916 (LA-UR—81-1404)
*See* Goldstein, J.C., 6:22434
**Hahn, H.J.,** *See* Edwards, J.J., 6:22622
**Haimson, B.,** *See* Doe, T., 6:21673
**Haire, R.G.,** *See* Ward, J.W., 6:22292
**Hakkila, E.A.,** Materials accounting considerations for international safeguards in a light-water reactor fuels reprocessing plant, 6:21715
**Halbach, K.,** Design of focussing and guide structures for charged particle

beams using rare earth cobalt permanent magnets, 6:22492 (LBL—12552)
**Halbig, J.K.,** Inspector-instrument interface in portable NDA instrumentation, 6:21695 (LA-UR—81-1402)
*See* Lee, D.M., 6:21716, 6:22056
**Hall, F.,** Solar heating of poultry laying houses in the northern states, 6:21884
**Hall, M.B.,** Generalized molecular orbital theory: a limited multiconfiguration self-consistent-field-theory, 6:22780 (LBL—12157, pp 31-50)
**Hall, R.B.,** Design and fabrication of high efficiency thin film CdS/Cu/sub 2/S solar cells, 6:21807
Thin-film polycrystalline $Cu_2S$/Cd/sub 1-x/Zn/sub x/ S solar cells of 10% efficiency, 6:21796
**Hall-Martindale, M.,** Performance of the solarium-assisted dormitory at the White Mountain School, Littleton, NH, 6:21918
**Haller, W.,** Final report on research on optical coatings, 6:22305 (DOE/DP/40094—T1)
**Hallquist, J.O.,** MAZE: an input generator for DYNA2D and NIKE2D, 6:22265 (UCID—19029)
**Halperin, D.A.,** PDL-24 solar monitoring system, 6:21909
**Hamblen, S.E.,** ORNL Energy Management System, 6:22173 (CONF-8003114—, pp 261-268)
**Hamelink, J.,** Bioavailability of chemicals in aquatic environments, 6:22588
**Hamilton, J.H.,** *See* Peker, L.K., 6:22852
**Hamman, J.P.,** Specificity of chemiluminescence in the metabolism of benzo[a]pyrene to its carcinogenic diol epoxide, 6:22615
**Hammer, D.A.,** *See* Sudan, R.N., 6:22909
**Hammond, J.,** *See* Liepins, R., 6:22941
**Hammond, R.P.,** *See* Hubbard, H.W., 6:22082
**Hamrick, J.T.,** Redesign of turbine-pump impeller and diffuser using hydrodynamic design techniques. Final report, 6:22239 (DOE/CS/40183—T1)
**Hanak, J.J.,** *See* Carlson, D.E., 6:21791
**Handler, R.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Handy, N.C.,** *See* Saxe, P., 6:22383
**Haney, R.,** *See* Hall, F., 6:21884
**Hanlon, J.,** Helios $CO_2$ fusion laser alignment system, 6:22964
**Hannifan, M.,** *See* Place, W., 6:21921
**Hansen, A.D.A.,** *See* Gundel, L.A., 6:22532
*See* Novakov, T., 6:22546
**Hanson, C.L.,** Steam ejector-condenser: stage I of a differential vacuum pumping station, 6:22454
**Hanson, J.B.,** *See* Chastain, C.J., 6:22663
**Hardigree, A.A.,** *See* Larimer, F.W., 6:22710
**Harding, C.V.,** Control of cell proliferation in rabbit lens epithelium, 6:22636
Energy dispersive x-ray analysis of human lens cataracts, 6:22647
Unit membrane redundancy in spherical structures within the ocular lens, 6:22669
**Harding, D.,** *See* Harding, C.V., 6:22636
**Hargis, A.M.,** *See* Benjamin, S.A., 6:22678, 6:22681
*See* Bishop, L., 6:22676
*See* Brewster, R.D., 6:22686
*See* Stephens, L.C., 6:22677
**Harlan, R.A.,** Uranium and plutonium assay of created waste by gamma ray, singles neutron, and slow neutron coincidence counting, 6:21689
**Harper, J.A.,** Stratigraphic cross section of the upper Devonian Perrysburg and Java formations and thier equivalents, Northwestern Pennsylvania, 6:21598 (METC/EGSP—14)
**Harrigan, R.W.,** Total energy systems design, 6:21840
**Harrill, S.F.,** *See* Adams, J.A.S., 6:21621
**Harris, J.S. Jr.,** *See* Zehr, S.W., 6:21801
**Harrison, D.,** *See* Colberg, P.J., 6:21729
**Harrison, M.A.,** Mirror fusion. Quarterly report, July-September 1980, 6:22887 (UCAR—10060-80-3)
**Hartkopf, V.,** *See* Loftness, V., 6:21897
**Hasbrouck, R.T.,** Commentary on differential-pressure measurements at high reference pressures, 6:22442 (EGG—1183-1800)
**Hasenmueller, N.R.,** Stratigraphic cross sections showing members of the New Albany Shale (Devonian and Mississippian) in Indiana, 6:21599 (METC/EGSP—816)
**Hatcher, C.R.,** *See* Lee, D.M., 6:22056
**Hatcher, C.W.,** Double-shell inertial confinement fusion target fabrication, 6:22934
**Hatlee, M.D.,** Stochastic flows in integral and fractal dimensions and morphogenesis, 6:22372
**Hauser, J.R.,** *See* Bedair, S.M., 6:21802
**Hausman, J.A.,** *See* Aigner, D.J., 6:22139
**Hauth, R.,** *See* Lehtomaki, N.A., 6:22022
**Haves, P.,** Heat transfer in passively cooled buildings, 6:21886
**Hawke, R.S.,** Results of railgun experiments powered by magnetic flux compression generators, 6:22429 (UCRL—84875(Rev.1))
*See* Brooks, A.L., 6:22430
**Hawryluk, R.J.,** Exposure and development models used in electron beam lithography, 6:22458
**Hayden, J.J.,** *See* Elliott, C.J., 6:22914
*See* Hanlon, J., 6:22964
**Hayes, J.,** 5th national passive solar conference, 6:21885
**Haynes, W.P.,** *See* Lewis, R., 6:21529
**Hazeltine, R.D.,** Quasi-linear diffusion and radial transport in tokamaks, 6:22899
**Hazelton, E.,** *See* Hinkson, J., 6:22489
**Hazen, T.C.,** Parasite fauna of the American alligator (Alligator mississippiensis) in South Carolina, 6:22659
**Hazi, A.U.,** Ab initio study of dissociative attachment of low-energy electrons to $F_2$, 6:22808
Molecular resonance phenomena, 6:22792 (UCRL—85858)
**Heady, E.O.,** Projected effects of energy policies on agricultural water use and irrigation, 6:22101
**Healey, J.,** *See* Spencer, D.W., 6:21743
**Hearn, W.,** *See* Hinkson, J., 6:22489
**Hebron, D.E.,** *See* Elliott, C.J., 6:22914
**Hedges, J.I.,** Chemical indicators of organic river sources in rivers and estuaries, 6:22563 (CONF-8009140—, pp 109-141)
**Hedstrom, J.C.,** *See* Balcomb, J.D., 6:21862
**Heffner, J.D.,** Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Heilmann, I.U.,** *See* Endoh, Y., 6:22319
**Helgeson, N.L.,** Generation of useful energy from process fluids using the Biphase turbine. Final report, 6:22242 (DOE/ET/15350—1)
**Heller, K.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Helm, J.M.,** *See* Rhodes, G.W., 6:21848
**Henderson, T.M.,** *See* Alexander, S.M., 6:22945
**Hendricks, C.D.,** Metallic and nonmetallic coatings for ICF targets, 6:21720 (UCRL—85140)
**Hendrie, S.D.,** Liquid photovoltaic/thermal collectors for residential applications, 6:21940 (DOE/ET/20279—137)
**Henley, E.M.,** *See* Hwang, W.P., 6:22830
*See* Miller, G.A., 6:22856
**Herbes, S.E.,** Critical pathways of polycyclic aromatic hydrocarbons in aquatic environments, 6:22584
**Herman, I.P.,** Development of advanced technologies for photochemical tritium recovery. Quarterly progress report, January 1, 1980-March 31, 1980, 6:22394 (UCID—18509-80-1)
**Herrmann, A.,** *See* Huberman, E., 6:22616
**Herrmannsfeldt, W.B.,** *See* Close, E., 6:22473
**Herschman, H.R.,** *See* Butler-Gralla, E., 6:22632
**Hesse, J.L.,** *See* Fortenberry, J.W., 6:21799
**Hessler, J.P.,** Optical properties of actinide and lanthanide ions, 6:22378
**Hessler, R.R.,** *See* Gomez, L.S., 6:21685
**Hester, R.D.,** *See* McCormick, C.L., 6:22310
**Hester, R.E.,** *See* Reginato, L.L., 6:22505
**Heumier, T.A.,** *See* Hughes, R.H., 6:22807
**Heuze, F.E.,** JPLAXD: a finite-element program for static plane and axisymmetric analysis of structures in jointed rocks, 6:22732 (UCID—19047)
**Hickman, B.J.,** Internal charge standardization for two-dimensional electrophoresis, 6:22620
*See* Nance, S.L., 6:22621
**Hicks, H.G.,** Radiochemical data collected on events from which radioactivity escaped beyond the borders of the Nevada test range complex, 6:22529 (UCRL—52934)
**Hildebrand, S.G.,** *See* O'Neill, R.V., 6:22611
**Hillegas, W.J.,** *See* Wise, K.D., 6:22933
**Hinkson, J.,** New, rugged, high power Cockcroft-Walton power supply, 6:22489 (LBL—11715)
**Hinman, C.A.,** *See* Randklev, E.H., 6:22036
**Hiratani, K.,** Reaction with metal ions of chloromethylated polystyrene resin containing dithiocarbamate group, 6:22404
**Hirschfeld, T.,** *See* Perry, D.L., 6:22340
**Hitchcock, D.A.,** *See* Hazeltine, R.D., 6:22899
**Ho, F.,** *See* Yoo, H., 6:21803
**Hobart, D.E.,** Electrochemical and spectroscopic studies of some less stable oxidation states of selected

lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**Hocker, L.,** *See* Lyons, P.B., 6:22879
**Hodges, L.,** Klegecell: a new lightweight insulating material with superior properties, 6:21906
**Hodgson, K.O.,** *See* Templeton, D.H., 6:22857
**Hoenig, C.L.,** *See* Tewhey, J.D., 6:21654
**Hoeschele, J.D.,** *See* Hsie, A.W., 6:22715
**Hoffert, M.I.,** Scheme for computing surface fluxes from mean flow observations, 6:22534
**Hoffman, A.,** *See* Ross, R., 6:21831
**Hoffman, G.A.,** *See* Lamb, W.J., 6:22315
**Hoffman, L.,** *See* Loftness, V., 6:21897
**Hoffman, M.A.,** *See* Werner, R.W., 6:22428
**Hogan, R.G.,** Strategic petroleum reserve (SPR) geological site characterization report, Bayou Choctaw Salt Dome. Sections I and II, 6:21595 (SAND—80-7140)
**Holcomb, R.S.,** Development support by ORNL for TVA AFBC Pilot Plant, 6:21992 (CONF-810567—1)
**Holder, J.,** *See* Hultman, K.L., 6:22268
**Holdren, J.P.,** Environmental aspects of renewable energy sources, 6:22141
**Holland, L.M.,** Studies of the biology and toxicology of oilshale materials, 6:22705 (LA-UR—81-1166)
**Holland, M.K.,** Computer-assisted controlled-potential coulometric determination of plutonium for safeguards measurements, 6:22353
**Holland, M.M.,** *See* Otavka, M.A., 6:22932
**Hollander, J.M.,** Annual review of energy. Volume 5, 6:22122
**Hollebeek, R.J.,** *See* Donald, M.H.R., 6:22470
**Holloway, D.C.,** *See* Fourney, W.L., 6:21575
**Holmes, S.A.,** *See* Ford, C.D., 6:21613
**Holmes, S.D.,** *See* Russell, J.J., 6:22820
**Holmgren, J.D.,** *See* Salvador, L.A., 6:21532
**Holoszyc, M.,** *See* Newman, D.A., 6:22228
**Holte, H.O.,** *See* Kendall, P.W., 6:21867
**Holzman, M.A.,** *See* Ogle, J.W., 6:22420
**Homyk, B.D.,** *See* Downs, R.L., 6:22948
*See* O'Holleran, T.P., 6:22949
**Honea, F.I.,** Pilot plant tests of peat for direct combustion in utility boilers, 6:21563
**Hood, C.B.,** Large scale cryopumps for fusion power systems, 6:22953
**Hooke, W.H.,** Review of remote-sensor potential for wind-energy studies, 6:21983 (DOE/ET/23151—80/1)
**Hootman, H.E.,** *See* Farber, M.G., 6:21669
*See* Orloff, D.I., 6:21670
**Hoots, S.S.,** *See* Beach, L., 6:22515
**Hoover, D.L.,** Correlation characteristics of surficial deposits with a description of surficial stratigraphy in the Nevada test site region, 6:22722 (DOE/ET/44802—T1)
**Hopkins, B.,** *See* Lyons, P.B., 6:22879
**Hopkins, J.B.,** *See* Powers, D.E., 6:22797
**Hopkins, W.,** Containment description and radionuclear status, 6:22075 (GEND—002, pp D.1-D.28)
**Horn, M.,** High rise buildings, 6:22211 (P—400-80-036)
**Horn, W.,** *See* Sugama, T., 6:22307
**Horner, M.W.,** Development of high-temperature turbine subsystem technology to a technology readiness status, Phase II. Quarterly report, January-March 1981, 6:21995 (DOE/ET/10340—T4)
High-temperature turbine technology program. Turbine subsystem design report: Low-Btu gas, 6:21994 (DOE/ET/10340—T3)
**Horton, J.R.,** Energy recovery in coal conversion, 6:21491 (CONF-8003114—, pp 491-506)
**Horton, W. Jr.,** Toroidal drift modes driven by ion pressure gradients, 6:22892
**Horwedel, J.E.,** *See* Ford, W.E. III, 6:22099
**Horwitz, E.P.,** *See* Kalina, D.G., 6:22349
**Hoskins, E.R.,** Geotechnical studies related to in situ lignite-gasification trials. Semi-annual technical report, October 1, 1980-March 31, 1981, 6:21506 (DOE/PC/30221—T1)
**Houser, T.,** Fundamentals of nitric oxide formation in fossil fuel combustion. Progress report, 29 June-28 September 1980, 6:22414 (DOE/ET/10593—T1)
**Howard, A.Q. Jr.,** Translation operator for finite dmensional electromagnetic fields, 6:22866 (UCID—19024)
**Howard, D.,** *See* Fugitt, J., 6:22488
**Howard, J.,** *See* Alonso, J.R., 6:22491
**Howard, J.H.,** Identification of geothermal reserves and estimation of their value, 6:21967 (LBL—11940)
**Hseuh, H.C.,** Performance of BNL-TSTA compound cryopump, 6:22452
**Hsie, A.W.,** Quantitative mammalian cell mutagenesis and a preliminary study of the mutagenic potential of metallic compounds, 6:22715
*See* O'Neill, J.P., 6:22714
**Hsieh, E.J.,** Recent advances in Pt coating of microspheres by a batch magnetron sputtering process, 6:22938
*See* Hendricks, C.D., 6:21720
**Hsieh, K.C.,** *See* Fraser, H.L., 6:21536
**Hsu, C.C.,** *See* Sobotka, L.G., 6:22851
**Hsu, H.H.,** 870.8-keV gamma ray from $PuO_2$, 6:21696 (LA-UR—81-1510)
Multi-energy gamma-ray automated scanning system, 6:22328 (LA-UR—81-1511)
**Hsu, Y.C.,** Forced vibration of a fluid-filled hydraulic fracture, 6:21975
**Hsue, S.T.,** *See* Cowder, L.R., 6:21712
*See* Lee, D.M., 6:21716, 6:22056
*See* Sampson, T.E., 6:22330
**Huang, C.Y.,** *See* Liebenberg, D.H., 6:22312
**Huang, K.N.,** Relativistic many-body theory of atomic transitions: the relativistic equation-of-motion approach, 6:22759 (ANL—80-126, pp 152-165)
**Huang, S.M.,** *See* Garg, D., 6:21499, 6:21500
**Hubbard, H.W.,** Some hydrogen-control considerations for ice-condenser nuclear plants, 6:22082 (UCRL—15345)
**Huberman, E.,** Alterations in polyamine levels induced by phorbol diesters and other agents that promote differentiation in human promyelocytic leukemia cells, 6:22616
**Hudgens, C.R.,** Demonstration of totally sampled wavelength dispersive XRF for use in the assay of the SNM content of dissolver solutions, 6:22354
**Hudson, B.J.,** *See* Joy, D.S., 6:21677
**Hudson, D.R.,** *See* Frome, E.L., 6:22671
**Hudson, S.R.,** Geothermal technology publications and related reports: a bibliography, January 1977-December 1980, 6:21954 (SAND—81-0662)
**Hughes, E.B.,** *See* Butler, H.S., 6:22486
**Hughes, R.H.,** Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**Hughes, V.W.,** Internal spin structure of the proton from high energy polarized e-p scattering, 6:22825 (SLAC-PUB—2674)
**Huie, A.,** *See* Lu, J.J., 6:22819
**Hulbert, G.M.,** Comparison of LMFBR piping response obtained using response spectrum and time history methods, 6:22073 (CONF-810625—15)
**Hulburt, D.A.,** Safety analysis of the CSTR-1 bench-scale coal liquefaction unit, 6:21504 (DOE/PC/30198—T3)
Safety analysis of the 1000 lb/day coal-liquefaction PDU, 6:21505 (DOE/PC/30198—T5)
**Hulet, E.K.,** Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:22413
**Hull, J.L.,** *See* Muckenthaler, F.J., 6:22039, 6:22040
**Hultman, K.L.,** Tunneling of mixed dumbbells in Al-Zn, 6:22268 (DOE/ER/01198—1352)
**Hunn, B.D.,** Building space heating: active systems, 6:21915
*See* Diamond, S.C., 6:22205
**Hunt, I.,** *See* Redford, L., 6:22601
**Hunter, P.M.,** *See* Netzel, D.A., 6:21593
**Huray, P.G.,** *See* Abraham, M.M., 6:21656
**Husinsky, W.R.,** Impurity studies in fusion devices using laser-fluorescence spectroscopy, 6:22902
**Hutchinson, D.L.,** Investigation of the geokinetics horizontal in situ oil shale retorting process. Quarterly report, January, February, March 1981, 6:21608 (DOE/LC/10787—77)
**Hwang, W.P.,** Parity violation in electron-deuteron scattering I. Methodology and elastic scattering, 6:22830
**Hyde, R.W.,** *See* Morrow, P.E., 6:22716

## I

**Ignat, D.W.,** Toroidal effects on propagation, damping, and linear mode conversion of lower hybrid waves, 6:22894
**Ihara, S.,** Algebraic aggregation of interconnected power system loads, 6:22020
**Iles, P.A.,** *See* Yoo, H.I., 6:21768
**Illige, J.D.,** Metal coatings for laser fusion targets by electroplating, 6:22939
**Im, K.H.,** Analysis of flow, gas-particle radiation, and particulate deposition in radiant boilers, 6:22143 (ANL/MHD—81-5)
**Imel, G.R.,** *See* Jassby, D.L., 6:22885
**Ingersoll, D.T.,** *See* Ragan, G.L., 6:21646
**Ingersoll, T.G.,** Moving passive into the mass market: the Acorn/Massdesign passive prototype, 6:21898
**Ingevald, K.,** *See* Doe, T., 6:21673
**Inlow, R.O.,** *See* Smith, G.S., 6:21704

**Inn, K.G.W.,** *See* Volchok, H.L., 6:22331
**Inokuti, M.,** *See* Dillon, M.A., 6:22802
**Iri, T.,** *See* Bailey, R.B., 6:22379
**Irwin, C.F.,** Hydrodynamics of coal-liquefaction dissolver configurations, 6:21514 (ORNL/MIT—326)
**Ishikawa, M.,** *See* Thomlinson, W., 6:22317
**Iwao, M.,** *See* Willey, C., 6:21537

## J

**Jackiw, R.,** How super-renormalizable interactions cure their infrared divergences, 6:22827
**Jackson, D.D.,** LASL analytical chemistry program for fissionable materials safeguards, 6:21718
**Jackson, D.M.,** Commercial scale development of the SRC-II process, 6:21525
**Jackson, D.W.,** *See* Gomez, L.S., 6:21685
**Jackson, L.J.,** Geophysical examination of coal deposits, 6:21545 (ICTIS/TR—13)
**Jackson, W.B.,** Photothermal deflection spectroscopy and detection, 6:22439
**Jacobs, R.B.,** *See* Simms, R.J., 6:22943
**Jacobsen, T.R.,** *See* Campbell, W.B., 6:22655
**Jacobson, A.R.,** Eight-chord $CO_2$ interferometer for plasma-density measurements on ZT-40, 6:22880 (LA-UR—81-1148)
**Jacobson, M.R.,** Toward efficiency at the interface: spectrally selective surfaces for photothermal conversion, 6:21952
**Jacoby, H.D.,** *See* Neff, T.L., 6:21651
**Jaenka, R.S.,** *See* Norrdin, R.W., 6:22689
**Jaenke, R.S.,** Renal alterations in Segment II and III perinatally irradiated beagles, 6:22691 (FDA—81-8042, pp 111-116)
*See* Benjamin, S.A., 6:22678
*See* Brewster, R.D., 6:22692
**James, M.B.,** High-current injector for the proposed SLAC linear collider, 6:22501 (SLAC-PUB—2701)
**Jampel, R.S.,** *See* Harding, C.V., 6:22669
**Jaramillo, S.A.,** *See* King, N.S.P., 6:22520
**Jaroska, M.F.,** *See* Niven, W.A., 6:22530
**Jarvinen, P.O.,** Performance characteristics of solar-photovoltaic flywheel-storage systems, 6:21762 (DOE/ET/20279—134)
**Jarvis, J.Y.,** *See* Fleissner, J.G., 6:21711
**Jassby, D.L.,** Fusion energy calorimeter for the tokamak fusion test reactor, 6:22885 (PPPL—1791)
**Jayadev, T.S.,** Solar ponds, 6:21949 (SERI/TR—731-587)
**Jedo, A.,** Investigation of coal preparation processes in the circulating stream of water subjected to pulsation, 6:21557 (DOE/TIC—1018563)
**Jeffries, C.D.,** *See* King, A.R., 6:22774
**Jellison, G.E.,** Optical-absorption measurements of pure and heavily doped silicon from 1.24 to 4.63 eV and the effect on solar-cell performance, 6:21758 (CONF-810526—26(Draft))
*See* Young, R.T., 6:21759
**Jennison, D.R.,** Analysis of transition metal carbonyl Auger line shapes, 6:22322
**Jensen, R.G.,** *See* Barraclough, J.T., 6:22594
**Joel, D.D.,** *See* Chandra, P., 6:22634
**Johnson, A.L.,** *See* Smith, R.D., 6:22341
**Johnson, B.T.,** Approaches to estimating microbial degradation of chemical contaminants in freshwater ecosystems, 6:22586
**Johnson, C.E.,** Oxygen getter coatings for fission reactor fuel pins, 6:22055
**Johnson, N. P.,** *See* Hsie, A.W., 6:22715
**Johnson, R.,** *See* Fugitt, J., 6:22488
*See* Nowak, J., 6:22502
**Johnson, R.R.,** Modelling summary data, 6:22990 (LBL—12350)
**Johnson, S.S.,** *See* Cowder, L.R., 6:21712
*See* Sampson, T.E., 6:22330
**Johnson, T.R.,** *See* Petrick, M., 6:22142
**Johnson, W.R.,** *See* Cheng, K.T., 6:22755
**Johnston, S.C.,** Experimental investigation into the application of spontaneous Raman scattering to spray measurements in an engine, 6:22259 (SAND—81-8642)
**Jolin, L.J.,** *See* Jacobson, A.R., 6:22880
**Jonas, J.,** *See* Lamb, W.J., 6:22315
**Jonath, A.D.,** Amorphous thin films for solar-cell applications. Technical progress report, 11 October 1980 to 15 January 1981, 6:21789 (SERI/PR—9237-1-T2)
**Jones, E.S.,** *See* Raymond, K.N., 6:22698
**Jones, G. II,** Energy storage in organic photoisomers, 6:21809
**Jones, G.L.,** Critical point correlations of the Yvon-Born-Green equation, 6:22875
**Jones, L.C.,** *See* Bennett, W.P., 6:22977
**Jones, M.M.,** Two innovative passive air thermosiphon houses in Santa Fe, 6:21907
**Jones, M.S. Jr.,** Microwave gaseous electrode development. Final report, 6:22150 (DOE/ET/15619—T1)
**Jones, P.C.,** Kathabar runaround energy recovery systems, 6:22235 (CONF-8003114—, pp 269-277)
**Jones, R.A.,** *See* Lee, G.F., 6:22585
**Jones, R.F.,** *See* Ghaffari, H.T., 6:22169
**Jordan, J.,** *See* Gurira, R.C., 6:22392
**Jorgensen, J.R.,** Improving tree growth on poor and medium sites through the use of legumes. Annual report, February 14, 1980-September 1, 1980, 6:22670 (DOE/SR/10702—1)
**Jortberg, R.E.,** Gasification combined cycle test facility at Powerton, 6:21526
**Jostan, J.L.,** *See* Alberth, W., 6:22293
**Joy, D.S.,** Logistics characterization for regional spent fuel repositories concept, 6:21677 (ONWI—124)
**Jr.,** *See* Jellison, G.E., 6:21758
**Junk, G.A.,** *See* Spalding, R.F., 6:22583

## K

**Kaelble, D.H.,** Study program for encapsulation materials interface for low-cost solar array. Annual report, January 1, 1980-December 31, 1980, 6:21766 (DOE/JPL/954739—4)
**Kaieda, K.,** *See* Lee, D.M., 6:21716, 6:22056
**Kaiser, W.R.,** Using presence of calcite cap rock in shales to predict occurrence of reservoirs composed of leached secondary porosity in the geopressured zone. Annual report, June 1, 1980-October 31, 1980, 6:21958 (DOE/ET/27111—2)
**Kalbalka, G.W.,** Mild and convenient conversion of ketones to the corresponding methylene derivatives via reduction of tosylhydrazones by bis(benzoyloxy)borane, 6:22386
**Kalbeitzer, F.L.,** *See* Bush, W.J., 6:22510
**Kalia, R.K.,** Melting of a two-dimensional electron lattice, 6:22862
**Kalina, D.G.,** Thermodynamics of extraction of U(VI) and Th(IV) from nitric acid by neutral phosphorus-based organic compounds, 6:22349
**Kalita, J.K.,** Method for solving a specific energy system on a minicomputer, 6:22988
**Kamat, P.V.,** Electron transfer in the quenching of protonated triplet methylene blue by ground-state molecules of the dye, 6:22398
**Kaminsky, M.,** *See* Das, S.K., 6:22960
**Kammerud, R.,** *See* Gadgil, A., 6:21920
*See* Place, W., 6:21921
**Kapchinskii, I.M.,** Particle dynamics in linear resonance accelerators, 6:22480 (LA-tr—80-10)
**Kaplan, I.R.,** *See* Brown, F.S., 6:22581
*See* Nissenbaum, A., 6:22574
*See* Presley, B.J., 6:22576, 6:22577, 6:22579, 6:22580
**Kapusta, J.I.,** Asymptotic mass spectrum and thermodynamics of the Abelian bag model, 6:22841
**Karabin, M.E.,** Implications of stress range for inelastic analysis, 6:22033 (CONF-810625—14)
**Karagianes, M.T.,** *See* Busch, R.H., 6:22707
**Karaki, S.,** Direct contact liquid-liquid heat exchanger for solar-heated and -cooled buildings. Final report, January 1, 1979-May 30, 1980, 6:21852 (DOE/CS/32867—T1)
**Karo, A.M.,** Molecular potentials and relaxation dynamics, 6:22790 (UCRL—85577)
Molecular potentials and relaxation dynamics, 6:22791 (UCRL—85577(Rev.1))
**Karvonen, L.G.,** *See* Allen, M.A., 6:22471
**Kasper, J.V.V.,** Effects of government policies on the economic viability of photovoltaic systems, 6:21835
**Katayama, Y.B.,** *See* Wang, R., 6:21644
**Katz, J.,** *See* Cohen, S.M., 6:22613
**Katzer, J.R.,** Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980, 6:21494 (DOE/ET/11429—T1)
**Kawecki, J.J.,** Genesis: the solar community, 6:21901
**Kaye, C.J.,** Timer powder-pressing study, 6:22424 (MLM—2826)
**Keeling, C.D.,** *See* Bacostow, R.B., 6:22550
**Kehler, P.,** *See* Chen, T.H., 6:22074
**Kelber, J.A.,** *See* Jennison, D.R., 6:22322
**Keller, B.M.,** Passive solar manufactured buildings for commercial applications, 6:21899

**Keller, D.,** *See* Sawyer, C.H., 6:22212
**Keller, G.L.,** Solar repowering/industrial retrofit systems study Gulf Mt. Taylor Uranium Mill solar retrofit system requirements specification, 6:21864 (MDC-G—8163A)
**Keller, G.R.,** *See* Mraz, J.R., 6:21959
**Kelley, M.E. III,** *See* Ingersoll, T.G., 6:21898
**Kelly, B.,** *See* Loxsom, F.M., 6:21889
**Kelly, C.J. Jr.,** Validation of remotely sensed data from a large network of solar heating and cooling installations, 6:21873 (SOLAR/0005—81/80, pp 59-66)
**Kelly, H.P.,** Review of many-body calculations, 6:22754 (ANL—80-126, pp 94-114)
**Kendall, P.W.,** Performance comparison of solar space heating systems of selected active sites in the National Solar Data Network, 6:21867 (SOLAR/0005—81/80, pp 1-15)
**Kendig, M.,** *See* Kaelble, D.H., 6:21766
**Kenney, G.B.,** *See* Flemings, M.C., 6:22267
**Kennish, W.J.,** Determination of thermal performance characteristics of modular passive solar storage walls, 6:21904
**Keppel, R.A.,** *See* Walker, R.D. Jr., 6:21578
**Kerler, W.,** Axial-vector anomaly in lattice gauge theory, 6:22829
**Kern, E.A.,** *See* Hakkila, E.A., 6:21715
*See* Thomas, C.C. Jr., 6:21694
**Kerr, E.C.,** *See* Bistirlich, J.A., 6:22847
**Kessler, E.G. Jr.,** *See* Deslattes, R.D., 6:22763
**Kessler, H.J.,** *See* Peck, J., 6:21905
*See* Peck, J.F., 6:22218
**Ketoff, A.,** *See* Schipper, L., 6:22206
**Khan, E.U.,** *See* Coffield, R.D., 6:22030
**Kheifets, S.,** Experimental observations and theoretical models for beam-beam phenomena, 6:22478 (SLAC-PUB—2700)
**Khuri, N.N.,** Coupling-constant analyticity and the renormalization group, 6:22838
**Kidnay, A.J.,** Enthalpy measurement of coal-derived liquids. Final technical progress report, 6:21496 (DOE/ET/13395—T1)
**Kiernan, G.P.,** *See* Lu, J.J., 6:22819
**Kim, J.,** *See* Otavka, M.A., 6:22932
**Kim, K.C.,** Point defects in uranium dioxide, 6:22297 (LBL—12548, pp 6-10)
**Kimmich, G.A.,** Intestinal transport: studies with isolated epithelial cells, 6:22625
**King, A.R.,** Measurement of pair interactions in neodymium ethyl sulfate, 6:22774 (DOE/EV/72005—T2)
**King, N.S.P.,** Nanosecond-gating properties of proximity-focused microchannel-plate image intensifiers, 6:22520 (LA-UR—81-1126)
**King, R.J.,** *See* Walters, A.B., 6:21565
**Kinney, L.F.,** Design of a super-insulated energy education center, 6:21912
*See* Ashley, C.M., 6:22215
**Kirshen, P.H.,** Computer model for small-scale hydropower policy analysis, 6:21735
**Kitchen, D.N.,** *See* Benjamin, S.A., 6:22678, 6:22681
*See* Bishop, L., 6:22676
**Klabunde, K.J.,** *See* Baltisberger, R.J., 6:21502
**Klainer, S.M.,** *See* Perry, D.L., 6:22340
**Klass, D.L.,** *See* Landahl, C.D., 6:21600
**Klee, H.,** Economics of solar energy systems: short term costing, 6:21749
**Kleier, D.A.,** *See* Antypas, W.G. Jr., 6:22385
**Klein, A.,** WKB quantization of pseudo spin Hamiltonians, 6:22873
**Klein, S.A.,** *See* Monsen, W.A., 6:21925
**Kleinhofs, A.,** *See* Owais, W.M., 6:22642
**Kleinschmidt, P.D.,** *See* Ward, J.W., 6:22292
**Klemm, H.A.,** Emissions inventory for the SURE Region. Final report, 6:22545 (EPRI-EA—1913)
**Klimas, P.C.,** Recent Darrieus vertical-axis wind turbine aerodynamical experiments at Sandia National Laboratories, 6:21988 (SAND—81-1108C)
**Klosterbuer, S.F.,** *See* Halbig, J.K., 6:21695
**Knapp, B.C.,** *See* Russell, J.J., 6:22820
**Knapp, R.,** *See* Clark, J.B., 6:21569
**Knauss, K.G.,** Desert varnish: potential for age dating via uranium-series isotopes, 6:22727
**Kobisk, E.H.,** High level waste fixation in cermet form, 6:21663 (CONF-8005107—, pp 297-316)
**Koch, E.E.,** *See* Weaver, J.H., 6:22283
**Koehler, D.R.,** Radiation-induced conductivity and high-temperature Q changes in quartz resonators, 6:22518 (SAND—81-0126C)
**Koester, J.K.,** *See* Eustis, R.H., 6:22144
**Kohler, K.,** *See* Frankel, R., 6:22481
**Koike, M.,** *See* Martoff, C.J., 6:22849
**Kok, B.,** *See* Golbeck, J.H., 6:22629
**Komarneni, S.,** *See* Scheetz, B.E., 6:22294
**Kondic, N.N.,** *See* Chen, T.H., 6:22074
**Kondo, I.,** *See* Cowder, L.R., 6:21712
**Konopnicki, M.J.,** *See* Shore, B.W., 6:22789
**Kool, L.B.,** Polymer shells by the droplet method, 6:22942
*See* Crawley, R.L., 6:22944
**Koopman, S.D.,** *See* Liston, D.H., 6:22985
**Kopstein, M.,** DOE peat program, 6:21521
DOE program for the development of a peat utilization technology, 6:21528
**Kortan, A.R.,** *See* Roelofs, L.D., 6:22287
**Kosar, B.H.,** *See* Gordon, H.T., 6:21896
**Koshel, P.,** Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))
**Koteras, J.R.,** Analytical studies of a parabolic line concentrator utilizing an aluminum honeycomb support structure and a thin glass reflector laminate, 6:21945 (SAND—80-1583)
**Kothandaraman, G.,** *See* Simons, G.A., 6:21562
**Kowalik, R.M.,** Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)
**Koza, D.M.,** *See* Wassinger, C.E., 6:21957
**Kozak, J.J.,** *See* Hatlee, M.D., 6:22372
*See* Jones, G.L., 6:22875
**Krafka, C.,** *See* Weaver, J.H., 6:22283
**Krause, C.,** Of mice and mutagens, 6:22697
**Kreisman, W.S.,** *See* Strong, S.J., 6:21827
**Krikorian, O.H.,** Proposed solar-furnace study of zinc sulfate decomposition, 6:21722 (UCRL—85743)
**Krishna, C.,** *See* Gaffney, J., 6:22260
**Krishnaswamy, S.V.,** Atom probe analysis of rf-sputtered a-Si:H films, 6:22325
Enhanced interdiffusion of Cu into rf-sputtered chromium oxide films, 6:22286
*See* Lo, C., 6:22303
**Kroger, P.,** *See* Netzel, T.L., 6:22626
**Kruger, C.H.,** *See* Eustis, R.H., 6:22144
**Krugman, P.,** NBER working paper series: oil and the dollar. Working Paper No. 554, 6:21589
**Ku, T.L.,** *See* Knauss, K.G., 6:22727
**Kuhlman, J.,** *See* Gray, J., 6:21941
**Kukacka, L.E.,** *See* Sugama, T., 6:22307
**Kulander, K.C.,** Inhibition of chemical reactions by a strong laser field, 6:22365
**Kunkel, W.B.,** *See* Schoenberg, K.F., 6:22889
**Kuntz, M.A.,** *See* Doherty, D.J., 6:21962
**Kunz, C.O.,** Methane-production-rate studies and gas-flow modeling for the Fresh Kills landfill, 6:21728 (NYSERDA—80-21)
**Kuo, J.,** Status of the Mobil process for converting methanol to high quality gasoline, 6:21527
**Kupperman, D.S.,** *See* Deininger, W.D., 6:22447
**Kurkowski, T.L.,** Design of passive commercial buildings: major lessons learned, 6:21895
**Kurth, R.E.,** *See* Bishop, T.A., 6:22067
**Kush, E.A.,** Hybrid photovoltaic/thermal systems with a solar-assisted heat pump, 6:21826
**Kustom, R.L.,** *See* Fuja, R.E., 6:22961
**Kwan, K.S.,** *See* Malin, J.M., 6:22396
**Kwart, H.,** *See* Katzer, J.R., 6:21494
**Kwatny, H.G.,** Coordination of economic dispatch and load-frequency control in electric power systems, 6:22018

## L

**Lacey, D.R.,** *See* Gunkel, W.W., 6:21989
**Lackey, M.E.,** *See* Holcomb, R.S., 6:21992
**Lackey, W.J.,** *See* Angelini, P., 6:21660
**LaFayette, P.R.,** *See* Chastain, C.J., 6:22663
**Lai, G.Y.,** Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers, 6:22029
**Laidig, W.D.,** Loop-driven graphical unitary group approach applied to the MCSCF problem, 6:22779 (LBL—12157, pp 23-26)
**Lakner, J.F.,** Hydrogen and deuterium sorption by selected rare earth intermetallic compounds at pressures up to 1500 atm, 6:22375
**Lamb, W.J.,** Self-diffusion in compressed supercritical water, 6:22315
**Lamm, D.,** Photovoltaic commercialization: an analysis of legal issues affecting a government-accelerated solar industry, 6:21753 (SERI/TR—434-423)
**Lamorte, M.F.,** *See* Bedair, S.M., 6:21802
**Lancaster, H.,** *See* Hinkson, J., 6:22489

**Land, J.F.,** *See* Begun, G.M., 6:22374
**Landahl, C.D.,** Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**Lander, G.H.,** *See* Sinha, S.K., 6:22318
**Landsman, E.E.,** Loss of line shutdown for line-commutated utility-interactive inverter, 6:21815 (DOE/ET/20279—128)
**Langner, D.G.,** *See* Sprinkle, J.K. Jr., 6:22350
**Larimer, F.W.,** Mutagenicity of N-nitrosopiperazine derivatives in Saccharomyces cerevisiae, 6:22710
**LaRiviere, J.R.,** *See* Singh, K.N., 6:21683
**Larsen, R.S.,** *See* Deiss, S.R., 6:22503
**Larson, R.J.,** Role of biodegradation kinetics in predicting environmental fate, 6:22589
**LaSalle, F.R.,** *See* Clark, G.L., 6:22060
**Lassahn, G.D.,** Methodologies for calculating measurement uncertainties, 6:22972 (CONF-810406—7)
**Latham, D.R.,** *See* Ford, C.D., 6:21613
**Laue, E.G.,** Actinometric measurement of solar ultraviolet, 6:21742
**Lauer, E.J.,** *See* Cook, E.G., 6:22457
**Laughlin, A.W.,** *See* Aldrich, M.J., 6:21956
**Laukemper, J.,** *See* Lyman, J.L., 6:22339
**Laulainen, N.S.,** *See* Alkezweeny, A.J., 6:22549
**Laurens, R.M.,** *See* Arnold, J.M., 6:21489
**Lawson, L.,** *See* Sawyer, C.H., 6:22212
**Lax, M.,** *See* Agrawal, G.P., 6:22438
**LeBrun, S.F.,** *See* Sandorfi, A.M., 6:22848
**Ledin, E.,** *See* deGrassie, J.S., 6:22927
**Lee, A.C.,** Cumulative probability of occurrence for ocular lesions in Segment III dogs, 6:22682 (FDA—81-8042, pp 67-71)
Reduction in eye volume after prenatal or neonatal irradiation, 6:22683 (FDA—81-8042, pp 72-74)
*See* Angleton, G.M., 6:22684, 6:22685
*See* Benjamin, S.A., 6:22678, 6:22690
*See* Bishop, L., 6:22676
*See* Brooks, R.K., 6:22688
**Lee, C.M.,** *See* Gilbert, P.A., 6:22362
**Lee, D.M.,** Examination of LWR irradiated fuel assemblies using simple ion chamber techniques, 6:22056
New developments in nondestructive measurement and verification of irradiated lwr fuels, 6:21716
**Lee, E.,** *See* Jones, G.L., 6:22875
**Lee, G.F.,** Role of biotransformation in environmental hazard assessment, 6:22585
**Lee, M.J.,** Mathematical models for the control program of the SLAC linear collider, 6:22472 (SLAC-PUB—2672)
*See* Donald, M.H.R., 6:22470
**Lee, M.L.,** Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
*See* Willey, C., 6:21537
**Lee, R.L.,** *See* Gresho, P.M., 6:22444, 6:22446
*See* Sani, R.L., 6:22445
**Lee, S.Y.,** Coal conversion solid wastes: characterization for environmental assessment, 6:21515 (ORNL/TM—7533)
**Lee, T.D.,** Theoretical high energy physics. Progress report, May 1, 1980-April 30, 1981, 6:22835 (DOE/ER/02271—T2)
**Lee, T.T.,** *See* Drake, J.F., 6:22895
**Lee, W.,** *See* Russell, J.J., 6:22820
**Lee, W.H.,** Computer modeling of massive LNG spills from storage tanks at Point Conception, Oxnard, and Los Angeles Harbor, California, 6:21601
Numerical simulation for two-phase jet problem, 6:22080 (LA-UR—81-317)
**Lee, W.W.,** *See* Okuda, H., 6:22890
**Lee, Y.N.,** Reaction kinetics of nitrogen dioxide with liquid water at low partial pressure, 6:22369
**Lee, Y.S.,** Computer simulations of a continuum system of molecules with a hard-core interaction in the grand canonical ensemble, 6:22867
**Leggett, D.,** *See* Rubin, R.M., 6:21639
**Lehtomaki, N.A.,** Robust control of multiterminal dc/ac systems, 6:22022
**Leininger, G.,** *See* Tang, A., 6:21490
**Lemming, J.F.,** *See* Fleissner, J.G., 6:21711
**Lemons, D.S.,** *See* Guiragossian, Z.G.T., 6:22917
**Lenihan, W.S.,** Power recovery and utilization program applicable to the gaseous diffusion process, 6:22237 (CONF-8003114—, pp 475-489)
**Lenz, F.,** Doorway state approach to optical potential scattering, 6:22855
**Leonard-Barton, D.,** *See* Rogers, E.M., 6:21737
**Lerner, S.,** Summary of the thermal evaluation of LWBR (LWBR Development Program), 6:22041 (WAPD-TM—1385)
*See* Stout, J.W., 6:22042
**Lesso, W.G.,** Operations research and systems analysis of geopressured/geothermal resources in Texas. Final report, 6:21966 (DOE/ET/27087—T1)
**Lester, M.I.,** Laser excitation of $SF_6$ in a transparent nozzle beam: collision-assisted absorption and up-pumping, 6:22397
**Letts, S.A.,** Ultrasmooth plasma polymerized coatings for laser-fusion targets, 6:21719 (UCRL—84475(Rev.1))
*See* Illige, J.D., 6:22939
**Leung, C.,** *See* Kaelble, D.H., 6:21766
**Leung, D.C.,** *See* Yoo, H.I., 6:21768
**Levar, T.E.,** *See* Farnham, R.S., 6:21553
**Levine, E.,** *See* Wolsko, T., 6:21811
**Lewis, B.D.,** *See* Barraclough, J.T., 6:22594
**Lewis, K.,** *See* Mitchell, W.G., 6:22352
**Lewis, R.,** Synthane process update, mid-'78, 6:21529
**Lewis, S.,** *See* Lothrop, F., 6:22490
**Lewontin, R.C.,** Study of mathematical models of mutation and selection in multi-locus systems. Annual progress report, October 1, 1980-September 30, 1981, 6:22637 (DOE/EV/02472—T1)
**Li, C.T.,** *See* Klein, A., 6:22873
**Li, T.K.,** In-line monitor of plutonium holdup in glovebox filters, 6:21707
**Liberatore, A.J.,** *See* Martin, J.W., 6:21522
**Liberman, I.,** Alignment accuracy of the Helios $CO_2$ laser, 6:22965
*See* Hanlon, J., 6:22964
**Lichtin, N.N.,** *See* Kamat, P.V., 6:22398
**Lichtman, A.,** Total and exchangeable calcium in mitogen-treated lymphocytes, 6:22644
**Lichtman, D.,** *See* Pena, J.L., 6:22951
**Lichtman, M.A.,** *See* Lichtman, A., 6:22644
*See* Moosavi, H., 6:22646
*See* Segel, G.B., 6:22643
**Liebenberg, D.H.,** Solid-state phase transitions in CuCl under hydrostatic pressures to 12.8 GPa, 6:22312 (LA-UR—81-1443)
**Lieber, M.,** Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**Lien, C.L.,** *See* Orr, F.M. Jr., 6:21576
**Lien, P.L.,** *See* Weissenberger, S., 6:22920
**Liepins, R.,** Plastic coating of microsphere substrates, 6:22941
**Lijinsky, W.,** *See* Larimer, F.W., 6:22710
**Lin, C.D.,** Atomic physics of strongly correlated systems, 6:22770 (CONF-810432—4)
**Lindau, I.,** *See* Shek, M.L., 6:22288
*See* Su, C.Y., 6:22323
**Lindquist, L.O.,** *See* Lee, D.M., 6:21716
**Lindsey, L.L.,** Test building instrumentation cooperative agreement: heating/daylighting prototype development. Phase II. Passive and hybrid solar manufactured building project. Project status report No. 2, April 16, 1980-March 16, 1981, 6:21850 (DOE/CS/30367—T1)
**Linstadt, J.E.,** *See* Donald, M.H.R., 6:22470
**Liston, D.H.,** Multitest, DVM-based data acquisition system on an LSI-11/23, running under RSX-11M, 6:22985 (UCRL—85310)
**Liu, B.,** *See* Dupuis, M., 6:22782
**Liu, J.S.K.,** Heat transfer in vertical countercurrent steam-water flooding flows, 6:22084
**Livingston, A.E.,** Summary on experiments, 6:22768 (ANL—80-126, pp 286-300)
**Lo, C.,** Moessbauer characterization of reactively sputtered iron nitride films, 6:22303
**Loef, G.O.G.,** *See* Hunn, B.D., 6:21915
**Loew, G.A.,** *See* Clendenin, J.E., 6:22500
**Loewer, O.J.,** *See* Parker, B.F., 6:21951
**Loftness, V.,** Passive solar retrofit of all glass office buildings, 6:21897
**Logg, C.A.,** *See* Deiss, S.R., 6:22503
**Long, C.L.,** Audio-magnetotelluric data log and station-location map for the Silver Star Hot Springs area, Montana, 6:21963 (USGS-OFR—79-1307)
**Long, J.C.S.,** *See* Witherspoon, P.A., 6:22730
**Long, P.E. Jr.,** Examination of some simple numerical schemes for calculating scalar advection, 6:22531
**Longnecker, A.A.,** April 1981 environmental data for sites in the National Solar Data Network, 6:21741 (SOLAR/0010—81/04)
**Looney, L.D.,** *See* Lyons, P.B., 6:22879
**Loree, T.R.,** Laser-induced breakdown spectroscopy: detecting sodium and potassium in coal gasifiers, 6:22329 (LA-UR—81-1526)
**Lorensen, L.E.,** *See* Hatcher, C.W., 6:22934
**Lorsch, H.G.,** *See* Crane, R.E., 6:21931

**Lothrop, F.,** Physics and medicine: the Bevatron/Bevalac experience, 1979-1980, 6:22490 (LBL—11719)
**Lott, D.F.,** Test results of heat-exchanger cleaning in support of ocean thermal energy conversion, 6:21841 (DOE/CH/00135—3)
**Lotz, W.G.,** *See* Lu, S.T., 6:22720
**Louis, J.F.,** Coal combustion studies. Task 4a, 6:21560 (DOE/ET/15518—3, pp 111-149)
Detailed description of technical progress task 1, arcing phenomena in MHD generators, 6:22146 (DOE/ET/15518—3, pp 9-69)
Electrode module development and testing. Task 3, 6:22148 (DOE/ET/15518—3, pp 90-110)
Key contributions in MHD power generation. Quarterly technical progress report, September 1, 1979-November 30, 1979, 6:22145 (DOE/ET/15518—3)
Open cycle disk generator program. Task 2, 6:22147 (DOE/ET/15518—3, pp 70-89)
*See* Rosenbaum, M., 6:22814
**Loveless, R.L.,** *See* Russell, J.J., 6:22820
**Lovering, S.L.,** *See* Benjamin, S.A., 6:22678, 6:22681
*See* Bishop, L., 6:22676
*See* Stephens, L.C., 6:22677
**Lowell, C.,** Multi-stage desulfurizing fluid-bed combustor for coal-fired hot gas generator systems: Topical report No. 3. Task 6. Modifications to Materials Handling Equipment. Task 7. Testing, 6:22459 (DOE/ET/10484—T2)
**Lowndes, D.H.,** Pulsed-laser annealing of ion-implanted semiconducting GaAs for homojunction solar cells, 6:21760 (CONF-810526—28(Draft))
Time-resolved reflectivity during pulsed-laser irradiation of GaAs, 6:22314
**Loxsom, F.M.,** Passive nocturnal cooling resource assessment using validated heat transfer equations, 6:21889
Validation of heat transfer coefficients for passive cooling, 6:21930
**Lu, A.H.,** *See* Kunz, C.O., 6:21728
**Lu, J.J.,** Exploratory studies on relativistic heavy-ion central collisions, 6:22819
**Lu, M.C.,** *See* Young, R.T., 6:21759
**Lu, S.T.,** Advances in microwave-induced neuroendocrine effects: the concept of stress, 6:22720
**Lucas, D.,** Characterization of the selective reduction of NO by $NH_3$, 6:22465 (LBL—12215)
Influence of fuel sulfur on the selective reduction of NO by $NH_3$, 6:21596 (LBL—12128)
**Luera, T.F.,** Radiation environment behind CdO loaded polyethylene conversion material exposed to a fast burst reactor, 6:22062 (SAND—81-0749C)
**Luhmann, N.C. Jr.,** *See* Peebles, W.A., 6:22437
**Lujan, R.E.,** *See* Day, R.D., 6:22915
**Luk, K.B.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Luke, W.D.,** Nuclear magnetic resonance studies of uranocenes, 6:22411
**Lukens, L.L.,** Experimental parabolic trough collector performance characterization, 6:21947 (SAND—81-0313)
**Lundberg, B.,** *See* Wilkinson, C., 6:22821
**Lundberg, L.B.,** Evaluation of molybdenum and its alloys, 6:22273 (LA-UR—81-1400)
**Lunde, P.J.,** Prediction of the performance of passive heating systems using the base-temperature method of performance prediction, 6:21927
**Luther, F.M.,** *See* Penner, J.E., 6:22548
**Luthy, R.G.,** Treatment of coal coking and coal gasification wastewaters, 6:22651
**Lyman, J.L.,** Collisional redistribution of vibrational energy in $CO_2$-laser-excited benzene, 6:22339
**Lynch, D.W.,** *See* Weaver, J.H., 6:22283
**Lynn, B.W.,** Magnetic moment of massive neutrinos and the cosmic helium abundances, 6:22826
**Lyon, W.S.,** Analytical Chemistry Division. Annual progress report for period ending December 31, 1980, 6:22332 (ORNL—5738)
**Lyons, P.B.,** High-speed photodetector for plasma diagnostics, 6:22879 (LA-UR—81-1028)
*See* Ogle, J.W., 6:22420

## M

**MacCracken, M.C.,** *See* Ellingson, R.G., 6:22533
**MacDonald, J.L.,** *See* Eccleston, G.W., 6:21690
**Machiels, A.J.,** Thermal-gradient migration of brine inclusions in salt, 6:22724 (LBL—12548, pp 53-57)
**MacKenzie, F.T.,** Global carbon cycle: some minor sinks for $CO_2$, 6:22571 (CONF-8009140—, pp 360-384)
**MacLaren, V.A.,** *See* Van Denventer, E.H., 6:22952
**MacLean, S.,** *See* Shultz-McKinley, S., 6:21686
**MacMillan H.F. Jr.,** *See* Jonath, A.D., 6:21789
**Madden, H.H.,** Chemical information from Auger electron spectroscopy, 6:22348
**Madsen, K.,** *See* Weissenberger, S., 6:22920
**Maeda, B.T.,** *See* Treleven, K., 6:21846
**Magara, K.,** *See* Kaiser, W.R., 6:21958
**Magid, L.M.,** *See* Prince, M.B., 6:21825
**Mahaffy, M.A.,** *See* Chowdhuri, P., 6:22014
**Mahajan, S.M.,** *See* Hazeltine, R.D., 6:22899
**Maiya, P.S.,** *See* Majumdar, S., 6:22276
**Majumdar, S.,** Mechanistic model for time-dependent fatigue, 6:22276
**Maki, A.W.,** Biotransformation and fate of chemicals in the aquatic environment, 6:22582
**Makohon, P.A.,** *See* Farber, M.G., 6:21669
**Malhotra, R.,** *See* Ruch, R.R., 6:21538
**Malin, J.M.,** Laser-flash-induced dissociation and recombination of aqueous pentacyano (2-methylpyrazine)ferrate(II) ion, 6:22396
**Malinowski, M.E.,** Detection of a $ScD_2$ film decomposition by AES, 6:22321
Thermal decomposition of Ti getter films from the DITE tokamak, 6:22928
**Mallavarpu, R.,** *See* Jones, M.S. Jr., 6:22150
**Malterer, T.J.,** Peat resource estimation project in Minnesota, 6:21549
**Malysa, L.,** *See* White, D.H., 6:21955
**Mancini, F.,** *See* White, D.H., 6:21955
**Mann, L.K.,** *See* McLaughlin, S.B., 6:22712
**Mann, R.,** *See* Mullaney, P.F., 6:22630
**Manning, J.J.,** *See* Muckenthaler, F.J., 6:22039, 6:22040
**Manning, R.,** Measurements and simulations of radiative cooling through IR transparent windscreens, 6:21888
**Mansfeld, F.B.,** *See* Kaelble, D.H., 6:21766
**March, N.H.,** *See* Baird, J.K., 6:22812
**Margolies, D.,** *See* Truett, T., 6:22538
**Margolin, J.B.,** California solar energy study: decision-analysis panel report, 6:21738 (DOE/EIA/10189—T3)
**Marietta, M.G.,** *See* Gomez, L.S., 6:21685
**Markley, R.A.,** *See* Coffield, R.D., 6:22030
**Markowitz, S.S.,** *See* Oblath, S.B., 6:22366
**Marling, J.B.,** *See* Herman, I.P., 6:22394
**Marlow, W.,** *See* Gaffney, J., 6:22260
**Maroni, V.A.,** *See* Van Denventer, E.H., 6:22952
**Marrus, D.M.,** *See* Burek, A.J., 6:22742
**Marsh, S.F.,** *See* Jackson, D.D., 6:21718
**Marshall, L.S.,** Analysis and performance evaluation of an air thermosyphon system, 6:21908
**Marshall, R.S.,** *See* Li, T.K., 6:21707
**Marsters, R.,** *See* Milewski, J., 6:22950
**Martin, J.F.,** Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)
**Martin, J.W.,** Outlook for in situ gasification of eastern coal, 6:21522
**Martin, R.W.,** *See* Vasilik, D.G., 6:22860
**Martin, S.,** Ecomomic implications of a passive solar retrofit program in Albuquerque, New Mexico, 6:21894
**Martin, W.C.,** Energy levels of highly ionized atoms, 6:22762 (ANL—80-126, pp 195-214)
**Martinez, R.S.,** *See* Schmidt, J.E., 6:22031
**Martner, B.E.,** Wind characteristics in suthern Wyoming, 6:21982
**Martoff, C.J.,** Orbital recoupling dominance in the A = 20 isovector giant M1 transition, 6:22849
**Marwitz, J.D.,** *See* Martner, B.E., 6:21982
**Maser, M.,** *See* Harding, C.V., 6:22647
**Maskarinec, M.P.,** *See* Herbes, S.E., 6:22584
**Mason, G.W.,** *See* Kalina, D.G., 6:22349
**Masuda, M.,** *See* Eyssa, Y.M., 6:22085
**Mathey, R.G.,** Guidelines for the installation of solar components on low-sloped roofs, 6:21944 (NBS-TN—1134)
**Matney, E.A.,** *See* Ruhe, R.V., 6:22729
**Matsumura, F.,** Use of a microcosm approach to assess pesticide biodegradability, 6:22593
**Mattice, J.S.,** *See* DeAngelis, D.L., 6:22610
**Mattox, D.M.,** Coatings for fusion reactor environments, 6:22955
*See* Mullendore, A.W., 6:22923, 6:22957
**Matyi, R.J.,** *See* Amelse, J.A. Hill, 6:22370
**Matzen, M.K.,** Structure and observable characteristics of laser driven ablation, 6:22906 (DOE/DP/40003—T1, pp 5p, Paper 1)
**Maycock, P.D.,** *See* Prince, M.B., 6:21825

**Mayer, C.B.,** High response control of stator watts and vars for large wound rotor induction motor adjustable speed drives, 6:22962
**McAdoo, J.W.,** *See* Ford, W.E. III, 6:22099
**McBride, R.B.,** Union Carbide Corporation: energy conservation program, 6:22231 (CONF-8003114—, pp 47-52)
**McBroome, L.A.,** *See* Doherty, D.J., 6:21962
**McCabe, M.,** *See* Kennish, W.J., 6:21904
**McCafferty, D.,** *See* Chou, T.S., 6:22453
*See* Foerster, C.L., 6:22450
**McCarty, P.L.,** *See* Colberg, P.J., 6:21729
**McCarville, M.E.,** *See* Houser, T., 6:22414
**McCaskill, J.S.,** *See* Baird, J.K., 6:22812
**McCauley, E.W.,** Method for chug classification, 6:22083 (UCRL—85707)
**McClung, J.D.,** *See* Martin, J.W., 6:21522
**McConathy, R.K.,** *See* McLaughlin, S.B., 6:22712
**McConnell, R.A.,** *See* Allen, M.A., 6:22471
**McCormick, A.,** Solar training for women, a feminist perspective, 6:21739
**McCormick, C.L.,** Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310
Water-soluble copolymers. I. Synthesis of model dextran-g-polyacrylamides by Fe(II)/$H_2O_2$ initiation and characterization by aqueous size exclusion chromatography, 6:21574
**McCormick, J.,** Development of a polysilicon process based on chemical vapor deposition (Phase 1). Fifth quarterly progress report, 1 October-31 December 1980, 6:21769 (DOE/JPL/955533—81/5)
**McCrory, R.L.,** Taylor instability in fusion targets, 6:22908 (DOE/DP/40003—T1, pp 31p, Paper 3)
**McCulloh, K.E.,** Nitrogen sensitivities of a sample of commercial hot cathode ionization gage tubes, 6:22449
**McDonald, R.J.,** *See* Sobotka, L.G., 6:22851
**McDonald, W.M.,** *See* Liston, D.H., 6:22985
**McDowell, W.J.,** New advances in alpha spectrometry by liquid scintillation methods, 6:22516
**McEnerney, J.,** *See* Suckewer, S., 6:22886
**McGill, R.N.,** *See* Martin, J.F., 6:22088
**McGinnis, J.F.,** Cell surface modulation of gene expression in brain cells by down regulation of glucocorticoid receptors, 6:22617
**McGlynn, S.P.,** *See* Chattopadhyay, S., 6:22382
**McGregor, C.K.,** *See* Harrison, M.A., 6:22887
**McGurl, G.V.,** Gasifiers in industry: experiences on the first few projects., 6:21530
**McGurn, A.R.,** *See* Endoh, Y., 6:22319
**McInroy, J.F.,** Deposition and retention of plutonium in the United States general population, 6:22556 (LA-UR—81-1175)
*See* Volchok, H.L., 6:22331
**McKean, A.L.,** *See* Allam, E.M. Sr., 6:22013
**McKinstry, M.,** *See* Kennish, W.J., 6:21904
**McKown, H.S.,** *See* Walton, J.R., 6:21693
**McLane, S.B.,** *See* Krishnaswamy, S.V., 6:22325
**McLarnon, F.,** *See* Cairns, E., 6:22092
**McLaughlin, S.B.,** Effects of $SO_2$ dosage kinetics and exposure frequency on photosynthesis and transpiration of kidney beans (Phaseolus vulgaris L.), 6:22712
**McLemore, D.R.,** Automated in-line measurement of nuclear fuel pellets, 6:21708
**McLeod, J.,** *See* Elliott, C.J., 6:22914
**McNealey, J.J.,** *See* Bishop, T.A., 6:22539
**McNerney, G.M.,** Accelerometer measurements of aerodynamic torque on the DOE/Sandia 17-m Vertical Axis Wind Turbine, 6:21987 (SAND—80-2776)
**McWilliams, K.D.,** *See* Lerner, S., 6:22041
*See* Stout, J.W., 6:22042
**McWilliams, R.,** Currents generated by lower hybrid waves, 6:22882 (PPPL—1774)
**McWilliams, T.M.,** Verification of timing constraints on large digital systems, 6:22981 (UCRL—83791(Rev.1))
**Meade, R.H.,** *See* Nordin, C.F. Jr., 6:22565
**Meakin, J.D.,** *See* Hall, R.B., 6:21796, 6:21807
**Meason, J.L.,** *See* Luera, T.F., 6:22062
**Medina, E.G.,** *See* Lee, D.M., 6:22056
**Meeks, J.L.,** *See* Chattopadhyay, S., 6:22382
**Meiselman, H.J.,** *See* Corry, W.D., 6:22718
**Meister, M.J.,** *See* Walker, R.D. Jr., 6:21578
**Melen, R.,** New generation control system at SLAC, 6:22504 (SLAC-PUB—2704)
**Mensing, R.W.,** *See* Truett, T., 6:22538
**Menzie, D.,** *See* Clark, J.B., 6:21569
**Merigan, W.H.,** Temporal modulation sensitivity of macaque monkeys, 6:22665
**Merkle, K.L.,** *See* Averback, E.S., 6:22272
**Merrigan, M.,** Ceramic heat pipe development. Semi-annual report, 1 October 1980-31 March 1981, 6:22418 (DOE/TIC—1022096)
**Merrigan, M.A.,** Ceramic heat exchangers: manufacturing techniques and performance, 6:22423 (LA-UR—81-1643)
**Mertens, R.,** *See* Cheek, G., 6:21793
**Merz, W.E.,** *See* Wright, I.G., 6:21497
**Meschter, P.J.,** *See* Brooks, C.R., 6:22271
**Messer, C.,** *See* Loxsom, F.M., 6:21930
**Messier, R.,** *See* Krishnaswamy, S.V., 6:22286, 6:22325
*See* Lo, C., 6:22303
**Mestriner, M.A.,** *See* Mohrenweiser, H., 6:22640
**Metcalf, S.G.,** Determination of EDTA and HEDTA in Hanford defense waste by high-performance liquid chromatography, 6:22336 (RHO-SA—218)
**Meybeck, M.,** River transport of organic carbon to the ocean, 6:22566 (CONF-8009140—, pp 219-269)
**Meyer, C.,** *See* deGrassie, J.S., 6:22927
**Meyer, C.H. Jr.,** *See* Smith, J.N. Jr., 6:22900
**Meyer, S.F.,** Metallic coating of microspheres, 6:22937
*See* Hendricks, C.D., 6:21720
*See* Hsieh, E.J., 6:22938
**Meyers, S.,** *See* Schipper, L., 6:22206
**Michaelson, S.M.,** *See* Lu, S.T., 6:22720
**Middleton, H.W.,** Comparison of semiautomatic and fully automatic water titrators, 6:22327 (GEPP-TIS—569)
**Migliazza, E.,** *See* Mohrenweiser, H., 6:22640
**Milanovich, F.P.,** *See* Perry, D.L., 6:22340
**Milewski, J.,** Tensile testing of glass microshells, 6:22950
**Miley, G.H.,** CTR plasma engineering studies. Annual progress report, 1 October 1980-30 September 1981, 6:22878 (DOE/ET/52040—T2)
**Millener, D.J.,** *See* Sandorfi, A.M., 6:22848
**Miller, C.W.,** Cardiovascular studies in long-term Segment III beagles sacrificed at 8 years of age, 6:22687 (FDA—81-8042, pp 90-94)
Experiences using B scanning techniques in the dog, 6:22645 (FDA—81-8042, pp 126-129)
Renal function changes associated with aging and ionizing radiation: a summary, 6:22693 (FDA—81-8042, pp 124-125)
*See* Brewster, R.D., 6:22692
**Miller, D.L.,** *See* Zehr, S.W., 6:21801
**Miller, F.A.,** Design and performance of atomizing nozzles for spray calcination of high-level wastes, 6:21680 (PNL—3702)
**Miller, G.A.,** Interpretation of some low equation results, 6:22856
**Miller, J.,** *See* Bistirlich, J.A., 6:22847
*See* deGrassie, J.S., 6:22927
*See* Province, S.G., 6:21965
**Miller, J.P.,** *See* Martoff, C.J., 6:22849
**Miller, J.R.,** Long range transfer of positive charge between dopant molecules in a rigid glassy matrix, 6:22381
**Miller, R.,** *See* Lothrop, F., 6:22490
**Miller, R.H.,** *See* Clendenin, J.E., 6:22500
*See* James, M.B., 6:22501
**Miller, S.,** *See* Perry, D.L., 6:22340
**Miller, W.H.,** Classical trajectory models for electronically nonadiabatic collision processes: A classical valence bond model for electronic degrees of freedom, 6:22801
**Millet, M.S.,** Graphic daylighting design method: including clear sky conditions, 6:22216
**Milligan, W.O.,** *See* Beall, G.W., 6:22373
**Milliken, K.L.,** *See* Kaiser, W.R., 6:21958
**Mills, R.L.,** *See* Liebenberg, D.H., 6:22312
**Minnick, L.J.,** Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)
**Minor, J.E.,** Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)
**Mintzer, I.,** *See* Holdren, J.P., 6:22141
**Misch, M.R.,** *See* Margolin, J.B., 6:21738
**Mitchell, B.W.,** *See* Drury, L.N., 6:21883
**Mitchell, J.W.,** *See* Utzinger, D.M., 6:21922
**Mitchell, W.G.,** Low level uranium determination by constant current coulometry, 6:22352
**Mitchner, M.,** *See* Eustis, R.H., 6:22144

**Mittleman, M.H.,** Derivation of a configuration space Hamiltonian for heavy atoms: three body potentials, 6:22750 (ANL—80-126, pp 27-44)
**Mixon, W.R.,** Appropriate energy technology for urban areas, 6:22247 (CONF-810565—1)
**Moddeman, W.E.,** *See* Ellefson, R.E., 6:22924
**Modine, F.A.,** *See* Jellison, G.E., 6:21758
**Moen, R.L.,** Solar energy management system, 6:21934
**Moenich, J.S.,** Nonevaporable getter for ion beam fusion, 6:22930
**Mohr, D.,** *See* Singer, R.M., 6:22063
**Mohr, P.J.,** Quantum electrodynamics of high-Z few-electron atoms, 6:22751 (ANL—80-126, pp 45-68)
**Mohrenweiser, H.,** Electrophoretic variants in three Amerindian tribes: the Baniwa, Kanamari, and central Pano of western Brazil, 6:22640
**Monahan, K.M.,** *See* Taylor, R.V., 6:22747
**Moncton, D.E.,** *See* Thomlinson, W., 6:22317
**Mongeau, J.G.,** *See* Annest, J.L., 6:22641
**Moniz, E.J.,** *See* Lenz, F., 6:22855
**Monsen, W.A.,** Prediction of direct gain solar heating system performance, 6:21925
**Monson, M.J.,** *See* Bern, C.J., 6:21879
**Montgomery, D.C.,** Energy conservative motors, 6:22234 (CONF-8003114—, pp 219-244)
**Monticello, D.A.,** *See* Strauss, H.R., 6:22897
**Montierth, L.,** Stationary flow model of ablatively imploded spherical shells, 6:22907 (DOE/DP/40003—T1, pp 72p, Paper 2)
*See* McCrory, R.L., 6:22908
**Moore, D.,** Solar project description for Helio-Thermics, Inc., Lot 6 single family residence; Greenville, South Carolina, 6:21874 (SOLAR/1025—81/50)
Solar project description for Matt Cannon multi-unit apartment, Gainesville, Florida, 6:21935 (SOLAR/1044—80/50)
**Moore, J.G.,** Survey of concrete waste forms, 6:21659 (CONF-8005107—, pp 194-216)
**Moore, J.W.,** *See* Bucher, I.Y., 6:22974
**Moore, R.H.,** Statistics and risk analysis: getting the acts together, 6:22069 (CONF-791016—, pp 171-176)
**Moore, R.L.,** *See* Wu, C.H., 6:22926
**Moosavi, H.,** Plastic-embedded human marrow biopsy specimens, 6:22646
**Moreau, J.W.,** Pahoa geothermal industrial park. Engineering and economic analysis for direct applications of geothermal energy in an industrial park at Pahoa, Hawaii, 6:21977 (DOE/ET/27233—T3)
**Morehouse, K.M.,** *See* Sevilla, M.D., 6:22399, 6:22400, 6:22405
**Morel, D.L.,** *See* Moustakas, T.D., 6:21787
**Moresco, L.L.,** Granular bed filter development program. Phase II. Quarterly report, June-August 1980, 6:21997 (DOE/ET/10373—T6)
**Moretto, L.G.,** *See* Sobotka, L.G., 6:22851
**Morgan, L.O.,** *See* Alei, M. Jr., 6:22389
**Morgenstern, M.H.,** Wire rope research and logging, 6:22425 (PNL-SA—8797)
**Morris, G.,** *See* Holdren, J.P., 6:22141
**Morris, V.L.,** *See* Randall, D.E., 6:21946
**Morris, W.A.,** Explosively produced fracture of oil shale, July-September 1979, 6:21607 (LA—8397-PR)
**Morris, W.S.,** *See* Jones, M.M., 6:21907
**Morrison, E.L.,** SPS susceptible-system cost factors investment summary and mitigation-cost-increment estimates, 6:21751 (DOE/ER/10160—T3)
**Morrison, G.,** Effect of water upon the critical points of carbon dioxide and ethane, 6:22367
**Morrison, P.J.,** Hamiltonian field description of two-dimensional vortex fluids and guiding center plasmas, 6:22884 (PPPL—1783)
**Morrow, P.E.,** Studies of pollutant aerosol simulants in normal and susceptible human subjects, 6:22716
**Morse, R.,** *See* Montierth, L., 6:22907
**Morse, R.L.,** Theoretical studies of plasma turbulence and hydrodynamic instability in fusion targets, 6:22905 (DOE/DP/40003—T1)
*See* Matzen, M.K., 6:22906
*See* McCrory, R.L., 6:22908
**Moser, B.D.,** *See* DeShazer, J.A., 6:21882
**Moser, S.B.,** *See* Garvey, D.B., 6:22535
**Mosier, J.,** *See* Wilems, R.E., 6:21678
**Mosley, W.C.,** Evaluation of an l/sub III/ x-ray absorption-edge densitometer for assay of mixed uranium-plutonium solutions, 6:22517
**Moss, C.E.,** CAMAC gamma ray scanning system, 6:21697 (LA-UR—81-1512)
**Moss, D.J.,** *See* Bacostow, R.B., 6:22550
**Motley, R.W.,** *See* McWilliams, R., 6:22882
**Moustakas, T.D.,** Sputtered amorphous silicon solar cells. Quarterly report No. 2, October 22, 1980-January 22, 1981, 6:21787 (SERI/PR—9219-T1)
**Mraz, J.R.,** Structure of the Presidio Bolson area, Texas, interpreted from gravity data, 6:21959 (DOE/ET/28388—T1)
**Mucci, J.,** Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)
**Muckenthaler, F.J.,** GCFR plenum shield design: shield heterogeneity experiment, 6:22039 (ORNL/TM—7714)
GCFR plenum shield design: exit shield experiment, 6:22040 (ORNL/TM—7715)
**Mueller, L.D.,** Trade-off between r-selection and K-selection in Drosophila populations, 6:22638
**Muetterties, E.L.,** *See* Schmidt, G.F., 6:22371
**Mughabghab, S.F.,** New aspects in the evaluation of thermal neutron cross sections, 6:22858 (BNL-NCS—29035)
**Mujahid, A.,** Solar radiation modeling and comparisons with current solar radiation models, 6:21744
**Mukunda, N.,** Evolution, symmetry, and canonical structure in dynamics, 6:22868
Form of relativistic dynamics with world lines, 6:22869
*See* Sudarshan, E.C.G., 6:22870
**Mulay, L.N.,** *See* Lo, C., 6:22303
**Mulcahy, T.M.,** Fluid forces on rods vibrating in finite length annular regions, 6:22053
**Mulford, R.,** *See* Farnum, E., 6:22936
**Mulholland, P.J.,** Deposition of riverborne organic carbon in floodplain wetlands and deltas, 6:22564 (CONF-8009140—, pp 142-172)
**Mullaney, P.F.,** Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density, 6:22630 (CONF-8005164—1)
**Mullendore, A.W.,** Mechanical properties of chemical vapor deposited coatings for fusion reactor application, 6:22923
Plasma-sprayed coatings for fusion reactor applications, 6:22957
*See* Pierson, H.O., 6:22959
**Muller, R.,** *See* Cairns, E., 6:22092
**Muller, R.H.,** *See* Geronov, Y., 6:22090
**Mullica, D.F.,** *See* Beall, G.W., 6:22373
**Munnecke, D.,** *See* Clark, J.B., 6:21569
**Munoz, D.,** *See* Sebald, A.V., 6:21924
**Murdock, J.F.,** *See* Schmidt, J.E., 6:22031
**Murnick, D.E.,** Precision determinations of high Z hydrogenic ion Lamb shifts, 6:22761 (ANL—80-126, pp 171-194)
**Murphy, J.,** *See* Hanlon, J., 6:22964
**Murphy, T.M.,** *See* Hazen, T.C., 6:22659
**Musinski, D.L.,** *See* Simms, R.J., 6:22943
**Myers, C.A.,** Michigan farm energy audit study: phase I, 6:22246
**Myers, D.W.,** *See* Letts, S.A., 6:21719
**Myers, W.D.,** Nuclear science. Annual report, July 1, 1979-June 30, 1980, 6:22844 (LBL—11588)
**Mynick, H.E.,** Verification of the classical theory of helical transport in stellarators, 6:22883 (PPPL—1781)
**Myrick, T.,** *See* Arbital, J., 6:21676

## N

**Nagami, M.,** *See* deGrassie, J.S., 6:22927
**Nakagawa, T.,** *See* Hiratani, K., 6:22404
**Nakamura, T.,** *See* Eustis, R.H., 6:22144
**Naman, T.M.,** Design and testing of a procedure for evaluating fuel-efficient crankcase lubricants, 6:21592 (DOE/BETC/RI—81/2)
**Nance, S.L.,** Method for studying proteins in 2-D gels using thermal denaturation analysis, 6:22621
**Narayan, J.,** *See* Lowndes, D.H., 6:21760
**Nasby, R.D.,** *See* Garner, C.M., 6:21774
**Nason, H.K.,** *See* Sullo, P., 6:22105
**Nathan, A.M.,** *See* Sandorfi, A.M., 6:22848
**Nealeigh, R.C.,** *See* Miller, C.W., 6:22687, 6:22693
**Neel, J.V.,** *See* Mohrenweiser, H., 6:22640
**Neff, T.L.,** International uranium market, 6:21651 (MIT-EL—80-014)
**Neidlinger, H.H.,** *See* McCormick, C.L., 6:22310
**Neill, J.M.,** Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)
**Nelson, M.,** *See* Lyons, P.B., 6:22879
**Nelson, R.L.,** *See* VanSant, J.H., 6:22954
**Nelson, R.W.,** Effective summary evaluators for deep nuclear waste repositories: geohydrologic response function., 6:21681 (PNL-SA—9092)
Use of Geohydrologic Response Functions in the assessment of deep nuclear waste repositories: assessment of effectiveness of

geologic isolation systems, 6:21692 (PNL—3817)
**Nelson, S.A.,** Partial molar volumes of oxide components in silicate liquids, 6:22734
**Nemat-Nasser, S.,** Geothermal energy: thermomechanics of heat extraction from hot, dry rock masses, 6:21974
**Nerheim, M.,** *See* Sawyer, C.H., 6:22212
**Nesnow, S.,** Tumorigenesis of diesel exhaust, gasoline exhaust, and related emission extracts on SENCAR mouse skin, 6:22702 (CONF-800323—4)
**Neta, P.,** *See* Behar, D., 6:22407
**Netzel, D.A.,** Hydrocarbon type analysis of jet fuels by $^{1}H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)
**Netzel, T.L.,** Electron transfer reactions in cofacial diporphyrins, 6:22626
**Newkirk, H.W.,** *See* Tewhey, J.D., 6:21654
**Newman, D.A.,** Evaluation of the Rochester, New York Community Transit Service Demonstration. Volume I: Executive Summary. Final report, November 1977-March 1980, 6:22228 (UMTA-NY—06-0048-81-1)
**Newman, J.,** *See* Cairns, E., 6:22092
**Newnam, B.E.,** *See* Foltyn, S.R., 6:22436
**Neyeloff, S.,** *See* Gunkel, W.W., 6:21989
**Ng, C.Y.,** *See* Ono, Y., 6:22395
**Ng, T.T.,** *See* Cheng, R.K., 6:22415
**Niccoli, L.G.,** *See* Wilburn, N.P., 6:22077, 6:22078
**Nichols, B.E.,** Carlisle house: an all-solar electric residence, 6:21817 (DOE/ET/20279—133)
**Nilan, R.A.,** *See* Owais, W.M., 6:22642
**Nilsson, J.S.,** *See* Mukunda, N., 6:22868
**Nissenbaum, A.,** Chemical and isotopic evidence for the in situ origin of marine humic substances, 6:22578
Early diagenesis in a reducing fjord, Saanich Inlet, British Columbia. I. Chemical and isotopic changes in major components of interstitial water, 6:22574
*See* Brown, F.S., 6:22581
**Nitschke, J.M.,** *See* Myers, W.D., 6:22844
**Niven, W.A.,** On-board data recorder for hard-target weapons, 6:22530 (UCRL—85730)
**Nix, J.R.,** Nuclear equation of state studied with high-energy heavy ions, 6:22854 (LA-UR—81-1555)
**Nodulman, L.,** Hybrid shower counters for CDF, 6:22514
**Nolan, M.,** *See* Fugitt, J., 6:22488
**Nolen, R.L.,** *See* Crawley, R.L., 6:22944
*See* Downs, R.L., 6:22948
*See* Kool, L.B., 6:22942
**Noll, S.A.,** *See* Martin, S., 6:21894
**Noonan, J.R.,** *See* Zehner, D.M., 6:22324
**Noorishad, J.,** *See* Witherspoon, P.A., 6:22730
**Nordham, D.,** *See* DeAngelis, M., 6:21917
**Nordin, C.F. Jr.,** Flux of organic carbon to the oceans: some hydrologic considerations, 6:22565 (CONF-8009140—, pp 173-218)
**Norrdin, R.W.,** Radiation effects on brain weight and gonad weight in Segment II beagles, 6:22689 (FDA—81-8042, pp 100-108)
*See* Jaenke, R.S., 6:22691
*See* Miller, C.W., 6:22693
*See* Stephens, L.C., 6:22679, 6:22680
**North, C.J.,** *See* Kaye, C.J., 6:22424
**Northrop, D.A.,** *See* Warpinski, N.R., 6:21603
**Northrop, G.M.,** Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Norton, F.J.,** Computer-aided design drafting/manufacturing (CADD/M) facility preparation, 6:22982 (UCRL—84964)
Cost justification for an interactive Computer-Aided Design Drafting/Manufacturing system, 6:22984 (UCRL—84966)
Selecting and implementing an interactive Computer Aided Design Drafting/Manufacturing (CADD/M) system, 6:22983 (UCRL—84965)
**Norton, R.D.,** *See* Cummings, R.D., 6:21667, 6:21668
**Norwood, D.P.,** *See* Garner, C.M., 6:21774
**Novak, J.,** *See* Bistirlich, J.A., 6:22847
**Novakov, T.,** Determination of relative concentrations of primary and secondary organics and speciation of sulfur compounds by thermal analysis and photoelectron spectroscopy, 6:22546 (LBL—12539)
*See* Gundel, L.A., 6:22532
*See* Oblath, S.B., 6:22366
**Novitskii, V.G.,** Some aspects of the study of gas-discharge plasma and production of high magnetic fields, 6:22152 (DOE-tr—73)
**Nowak, J.,** Pulse to pulse klystron diagnosis system, 6:22502 (SLAC-PUB—2702)
**Noyes, R.P.,** *See* Hasbrouck, R.T., 6:22442
**Nozari, F.,** *See* Lehtomaki, N.A., 6:22022
**Nunn, C.C.,** Adsorption from selected microemulsions onto alumina, 6:21579
**Nyman, D.H.,** *See* McLemore, D.R., 6:21708
**Nyman, M.,** *See* Alonso, J.R., 6:22491

## O

**O'Brien, B.J.,** Use of carbon isotope measurements to examine the movement of labile and refractory carbon in soil, 6:22555 (CONF-8009140—, pp 46-74)
**O'Hagan, J.B.,** *See* Walko, R.J., 6:21721
**O'Halloran, T.,** *See* Russell, J.J., 6:22820
**O'Hare, T.,** *See* Gaffney, J., 6:22260
**O'Holleran, T.P.,** Furnace profile effects on glass shell formation, 6:22949
**O'Leary, J.,** Energy issues, 6:22123
**O'Neill, J.P.,** Cytotoxicity and mutagenicity of alkylating agents in cultured mammalian cells (CHO/HGPRT system): mutagen treatment in the presence or absence of serum, 6:22714
*See* Hsie, A.W., 6:22715
**O'Neill, M.L.,** *See* Redford, L., 6:22601
**O'Neill, R.V.,** Natural variability as a source of error in model predictions, 6:22612
Theoretical implications of spatial heterogeneity in stream ecosystems, 6:22611
**O'Rear, D.J.,** *See* Sullivan, R.F., 6:21493
**O'Rourke, J.A.,** *See* Peterson, E.J., 6:21616
**O'Sullivan, M.J.,** *See* Schroeder, R.C., 6:21968
**Oblath, S.B.,** Kinetics of the formation of hydroxylamine disulfonate by reaction of nitrite with sulfites, 6:22366
**Ochoa, A. Jr.,** Discussion of the role of distributed effects in latch-up, 6:22456 (SAND—81-0658C)
**Ochoa, E.,** *See* Edwards, D.F., 6:22320
**Oddo, J.E.,** *See* Adams, J.A.S., 6:21621
**Ogden, J.M.,** Computer simulation of lower-hybrid heating in tokamaks. Final report, 6:22877 (DOE/ER/53106—T1)
**Ogle, J.,** *See* Lyons, P.B., 6:22879
**Ogle, J.W.,** Signal enhancement by spectral equalization of high-frequency broadband signals transmitted through optical fibers, 6:22420 (LA-UR—81-1038)
*See* King, N.S.P., 6:22520
**Ohta, T.,** *See* Oono, Y., 6:22804
**Okubo, S.,** *See* Tosa, Y., 6:22832
**Okuda, H.,** Numerical simulations of electrostatic hydrogen cyclotron instabilities, 6:22890
**Olander, D.R.,** Nuclear materials progress reports for 1980, 6:22264 (LBL—12548)
Tracer surface diffusion on $UO_2$, 6:22302 (LBL—12548, pp 58-61)
**Oliphant, G.W.,** UCC-ND energy conservation program to date, 6:22232 (CONF-8003114—, pp 53-64)
**Oliveira, Z.M.,** *See* Prussin, S.G., 6:22853
**Oliver, J.A.,** Assessment of the use of human factors in the design of fossil-fired steam-generating systems. Final report, 6:22004 (EPRI-CS—1760)
**Olness, D.U.,** LLNL underground coal gasification project. Quarterly progress report, October-December 1980, 6:21517 (UCRL—50026-80-4)
**Olsen, A.R.,** Nuclear fuel rod stored-energy uncertainty analysis: a study of error propagation in complicated models, 6:22068 (CONF-791016—, pp 71-81)
**Olsen, C.,** *See* Liebenberg, D.H., 6:22312
**Olsen, L.C.,** Investigation of solar cells based on $Cu_2O$. Progress report, June 1, 1980-November 30, 1980, 6:21786 (SERI/PR—9190-1-T1)
**Olson, C.,** *See* Chitre, S., 6:21781
**Olson, C.W.,** Operation of the PEP transverse beam feedback, 6:22477 (SLAC-PUB—2690)
**Olson, N.K.,** *See* Cohen, A.D., 6:21550
**Olszewski, M.,** Overview of waste-heat-utilization techniques, 6:22110
*See* Martin, J.F., 6:22088
**Onishi, Y.,** *See* Hiratani, K., 6:22404
**Ono, Y.,** Heat of formation of $C_2H^+$, 6:22395
**Oono, Y.,** Application of dimensional regularization to single chain polymer static properties: Conformational space renormalization of polymers. III, 6:22804
**Oppenheim, A.K.,** *See* Cheng, R.K., 6:21727
**Orbach, H.S.,** *See* Bjorken, J.D., 6:22871
**Orel, A.E.,** *See* Hazi, A.U., 6:22808
*See* Kulander, K.C., 6:22365
*See* Miller, W.H., 6:22801

**Orloff, D.I.,** Combustion-rate predictions for controlled-air incinerators, 6:21670 (DP-MS—81-8)
**Orr, F.M. Jr.,** Displacement of oil by carbon dioxide. Final report, 6:21571 (DOE/ET/12082—9)
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576
**Ortega, E.M.,** *See* Lee, D.M., 6:21716
**Ortega, J.K.E.,** Parametric evaluation of the double envelope building design using a detailed numerical thermal simulation model, 6:21845
*See* Connolly, J.M., 6:21929
**Orthel, J.L.,** *See* Guiragossian, Z.G.T., 6:22917
**Osborn, A.G.,** *See* Stallings, T.L., 6:22525
**Ostenak, C.A.,** *See* Thomas, C.C. Jr., 6:21694
**Oswald, R.L.,** *See* Crane, R.E., 6:21931
**Otavka, M.A.,** Doublet III neutral beam cryopumping system, 6:22932
**Ott, E.,** *See* Swegle, J., 6:22901
**Overseth, O.E.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Owais, W.M.,** In vivo conversion of sodium azide to a stable mutagenic metabolite in Salmonella typhimurium, 6:22642
**Owen, P.T.,** *See* Drury, J.S., 6:22595, 6:22596, 6:22597

## P

**Pacheco, A.J.,** *See* Sobotka, L.G., 6:22851
**Paffrath, L.,** *See* Deiss, S.R., 6:22503
**Paik, I.,** *See* Burness, H.S., 6:22109
**Palmer, R.F.,** *See* Busch, R.H., 6:22707
**Paris, D.F.,** *See* Baughman, G.L., 6:22591
**Park, L.S.,** *See* McCormick, C.L., 6:21574
**Park, R.L.,** *See* Roelofs, L.D., 6:22287
**Parker, B.F.,** Focusing solar air heater with rock storage, 6:21951
**Parker, J.L.,** *See* Cowder, L.R., 6:21712
*See* Sampson, T.E., 6:22330
**Parnell, R.,** *See* Hanlon, J., 6:22964
**Partridge, R.,** *See* Hanlon, J., 6:22964
**Pasupathi, V.,** *See* Davis, R.B., 6:22027
**Pasupathy, J.,** Higher-order JWKB expressions for the energy levels and the wavefunction at the origin, 6:22823 (DOE/ER/03992—423)
**Pate, B.B.,** *See* Shek, M.L., 6:22288
**Paterson, J.M.,** *See* Olson, C.W., 6:22477
**Patrick, R.E.,** *See* Batzer, T.H., 6:22931
**Paul, W.,** Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, January-March 31, 1980, 6:21764 (DOE/ET/23037—3)
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Final technical report, July 1, 1979-June 30, 1980, 6:22311 (DOE/ET/23037—4)
**Pawlewicz, W.T.,** Reactively sputtered oxide optical coatings for inertial confinement fusion laser components, 6:22958
**Pearson, C.F.,** *See* Fehler, M., 6:21961
**Peballk, W.L.,** *See* Gel'perin, N.I., 6:22360
**Peck, J.,** Windows for accepting or rejecting solar heat gain, 6:21905
**Peck, J.F.,** Integrating optimized evaporative cooling systems with passive homes, concepts and results, 6:22218
**Peebles, W.A.,** Unidirectional, pulsed far-infrared ring laser, 6:22437
**Peercy, P.S.,** *See* Doyle, B.L., 6:22787
**Peinado, C.O.,** Special applications of gas-cooled reactors, 6:22050 (GA-A—16262)
**Peker, L.K.,** Particle angular momentum alignment effects in deformed nuclei, 6:22852
**Pellegrin, J.L.,** Control electronics of the PEP RF system, 6:22493 (SLAC-PUB—2664)
*See* Clendenin, J.E., 6:22500
*See* Olson, C.W., 6:22477
**Pelletier, M.T.,** *See* Orr, F.M. Jr., 6:21576
**Pellin, M.J.,** Laser fluorescence spectroscopy of sputtered zirconium atoms, 6:22803
**Pelroy, R.A.,** *See* Toste, A.P., 6:21516
**Pena, J.L.,** Argon ion impact desorption cross sections of chlorine and carbon from nickel, 6:22951
**Penman, J.A.,** Bioindicators of the health of arctic foxes, 6:22660 (PNL-SA—9197)
**Penner, J.E.,** Comparison of observed and model-predicted $O_3$ trends, 6:22547 (UCID—19040)
Effect of temperature feedback and hydrostatic adjustment in a stratospheric model, 6:22548
**Peoples, J.,** *See* Russell, J.J., 6:22820
**Pepper, D.W.,** Computational codes for calculating dispersion from accidental releases of pollutants, 6:22543 (DP-MS—80-85)
High-order accurate numerical algorithm for three-dimensional transport prediction, 6:22987
Modeling pollutant dispersion within a tornadic thunderstorm, 6:22542 (DP-MS—80-84)
*See* Long, P.E. Jr., 6:22531
**Perez-Mendez, V.,** *See* Tam, K.C., 6:22872
**Perkins, R.A.,** Evaluation of alloys for fuel cell heat exchangers. Final report, 6:21511 (EPRI-EM—1815)
**Perloff, S.N.,** *See* Grundy, R.R., 6:21757
**Perone, S.P.,** *See* Richardson, J.H., 6:21797
**Perry, D.L.,** Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry, 6:22340
**Perry, J.E. Jr.,** *See* Balcomb, J.D., 6:21862
**Persoff, P.,** *See* Fox, J.P., 6:21617
**Person, S.,** *See* Bzik, D.J., 6:22650
*See* DeLuca, N., 6:22652
**Petersen, J.C.,** Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**Petersen, P.,** *See* deGrassie, J.S., 6:22927
**Peterson, D.R.,** *See* Hawke, R.S., 6:22429
**Peterson, E.J.,** Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
*See* Fox, J.P., 6:21617
*See* Thode, E.F., 6:21609
**Peterson, J.H.,** *See* Wright, I.G., 6:21497
**Peterson, J.R.,** Techniques of microchemistry and their applications to some transcurium elements at Berkeley and Oak Ridge, 6:22412
**Petrick, M.,** MHD heat and seed recovery technology project. Ninth quarterly report, January-March 1980, 6:22142 (ANL/MHD—80-8)
**Petrowski, C.,** *See* Presley, B.J., 6:22576, 6:22577, 6:22580
**Pfiefle, T.W.,** Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Phatak, S.B.,** *See* Bedair, S.M., 6:21802
**Phemister, R.D.,** *See* Benjamin, S.A., 6:22690
*See* Lee, A.C., 6:22683
*See* Norrdin, R.W., 6:22689
**Phillips, J.C.,** *See* Templeton, D.H., 6:22857
**Phillips, J.E.,** *See* Hall, R.B., 6:21796
**Phillips, J.R.,** *See* Lee, D.M., 6:21716, 6:22056
**Phillips, T.E.,** *See* Fox, J.P., 6:21615
**Phinney, J.A.,** *See* Sudbury, J.D., 6:21534
**Phung, D.L.,** Petroleum refining industry in the 1980s: impact of the National Energy Plan and related legislation, 6:21591 (ORAU/IEA—81-3(M))
**Piepel, G.F.,** Component effects in mixture experiments, 6:21652 (CONF-791016—, pp 7-19)
**Pierce, F.E.,** Life cycle cost analysis, 6:22116 (CONF-8003114—, pp 155-168)
**Pierson, H.O.,** Boron coatings on graphite for fusion reactor applications, 6:22959
*See* Mullendore, A.W., 6:22923
**Pietri, C.E.,** *See* Freeman, B.P., 6:22359
*See* Holland, M.K., 6:22353
**Pines, A.,** *See* Sinton, S., 6:22391
**Pines, H.,** Automatic tuning of the LBL Bevalac transfer line, 6:22468 (LBL—11580)
**Pirkle, F.L.,** Principal components analysis as a tool for interpreting NURE aerial radiometric survey data, 6:21642
**Pisarski, R.D.,** *See* Appeiquist, T., 6:22828
**Pitz, W.J.,** Modelling of burning and extinction characteristics of a polymer diffusion flame and comparison with experiment, 6:22416 (LBL—12214)
**Piwinskii, A.J.,** Dynamic viscosity of some silicate melts to 1688°C under atmospheric pressure, 6:22733
**Place, W.,** Human comfort and auxiliary control considerations in passive solar structures, 6:21921
**Plancher, H.,** *See* Petersen, J.C., 6:22343
**Platt, A.M.,** Commercial US nuclear reactors and waste: the status, December 1980, 6:21682 (PNL-SA—9231)
**Plumley, A.L.,** Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)
**Poe, R.T.,** *See* Lu, J.J., 6:22819
**Polednak, A.P.,** Mortality among men employed between 1943 and 1947 at a uranium-processing plant, 6:22695

**Pollock, E.L.,** Frequency-dependent dielectric response in polar liquids, 6:22816
**Pomeroy, L.R.,** Microbial roles in aquatic food webs, 6:22654
*See* Campbell, W.B., 6:22655
**Pondrom, L.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Pongratz, M.B.,** *See* Fitzgerald, T.J., 6:22743
**Pope, B.G.,** Toroidal magnetic detector, 6:22483 (DOE/ER/03072—1)
**Pope, M.,** State of fluidized bed combustion technology, 6:22462
**Porkolab, M.,** *See* Friedland, L., 6:22893
**Posner, G.H.,** *See* Hamman, J.P., 6:22615
**Post, H.N.,** Array subsystem development for photovoltaic-array fields, 6:21824 (SAND—81-1193C)
**Poteet, K.H.,** *See* Corbett, B.L., 6:22065
**Potter, R.,** *See* Arney, B., 6:21972
**Powell, E.C.,** Improving economic performance through insulation retrofit and the use of economic insulation thicknesses, 6:22177 (CONF-8003114—, pp 375-397)
**Powers, D.E.,** Vibrational relaxation in jet-cooled phenylalkynes, 6:22797
*See* Dietz, T.G., 6:22280
**Prasad, M.K.,** Construction of exact Yang-Mills-Higgs multimonopoles of arbitrary charge, 6:22842
Systematic framework for generating multimonopole solutions, 6:22839
**Pratt, J.C.,** *See* Hsu, H.H., 6:22328
*See* Moss, C.E., 6:21697
**Presley, B.J.,** Interstitial water chemistry, Leg 12, 6:22576
Interstitial water chemistry: Deep Sea Drilling Project, Leg 10, 6:22577
Interstitial water chemistry: Deep Sea Drilling Project, Leg 11, 6:22579
Interstitial water chemistry: Deep Sea Drilling Project, Leg 14, 6:22580
*See* Nissenbaum, A., 6:22574
**Preston, R.J.,** Effect of cytosine arabinoside on the frequency of x-ray-induced chromosome aberrations in normal human leukocytes, 6:22699
**Prevo, P.R.,** Shield-verification survey of a large hot cell at the FFTF, 6:22059 (HEDL-SA—2044)
**Price, B.,** *See* Bishop, T.A., 6:22539
**Price, T.W.,** Vehicle test report: South Coast Technology electric conversion of a Volkswagen Rabbit, 6:22261 (DOE/CS/54209—2)
**Prince, M.B.,** DOE perspective on photovoltaics development, 6:21825
**Pritchard, D.A.,** Real-time performance testing of photovoltaic-concentrator modules, 6:21776 (SAND—81-1145C)
**Province, S.G.,** Baca Geothermal Demonstration project legal and regulatory challenges. First semi-annual report for period through June 30, 1980, 6:21965 (DOE/ET/27163—2)
**Pruess, K.,** Performance matching and prediction for Serrazzano geothermal reservoir by means of numerical simulation, 6:21960 (LBL—12174)
*See* Schroeder, R.C., 6:21968
**Prussin, S.G.,** Gamow-Teller strength distribution in the vicinity of A = 90. Pt. 1. Schematic calculation of GT strength in $^{90,92,94}$Nb, 6:22853
**Pulle, C.V.,** Quantitative analysis of the economically recoverable resource, 6:21597 (DOE/MC/08216—157)
**Punwani, D.V.,** Peatgas process development status, 6:21518
SNG from peat by the PEATGAS process, 6:21531
**Puri, V.M.,** Status and prospects of local solar heating and cooling systems, 6:21933

## Q

**Quigg, C.,** Introduction to gauge theories of the strong, weak, and electromagnetic interactions, 6:22824 (FERMILAB-Conf—80/64THY)
**Quinby, T.C.,** *See* Kobisk, E.H., 6:21663

## R

**Rabitz, S.H.,** Electronic structure of hydrodesulfurization catalysts, 6:21581
**Radke, C.J.,** *See* Schmidt, D.P., 6:21577
**Radmer, R.,** Mass spectrometric determination of hydroxylamine photooxidation by illuminated chloroplasts, 6:22666
**Radziemski, L.J.,** *See* Loree, T.R., 6:22329
**Ragan, G.L.,** System for nondestructive assay of spent fuel subassemblies--comparison of calcuations and measurements, 6:21646
**Raghavan, R.,** Solar repowering/industrial retrofit system for the Provident Energy Company Refinery. Topical report, September 28, 1979-July 15, 1980, 6:21860 (DOE/SF/10606—T1)
**Raghuraman, P.,** *See* Hendrie, S.D., 6:21940
**Rahn, R.O.,** *See* Hsie, A.W., 6:22715
**Rains, D.,** Diffusion of solar energy technologies in the new-construction market: a survey of new solar-home and onventional-home buyers, 6:21853 (DOE/EIA/10189—T2)
**Rameika, R.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Ramey, D.W.,** *See* Kobisk, E.H., 6:21663
**Ramey, H.J. Jr.,** *See* Satman, A., 6:21570
**Ramsay, J.B.,** *See* Davis, W.C., 6:22523
**Ramsdell, J.V.,** Wind measurement systems and wind tunnel evaluation of selected instruments, 6:21978 (PNL—3435)
**Ramshaw, J.D.,** Brownian motion in a flowing fluid revisited, 6:22815
**Randall, D.E.,** Initial experience and preliminary results: solar collector materials exposure to the IPH site environment, 6:21946 (SAND—81-0290)
**Randall, J.E.,** Survey of ciguatera at Enewetak and Bikini, Marshall Islands, with notes on the systematics and food habits of ciguatoxic fishes, 6:22573
**Randklev, E.H.,** Irradiated mixed-oxide-fuel and fission-gas-release behavior during ex-reactor thermal-transient tests, 6:22036 (HEDL-SA—2175)
**Rao, K.R.P.M.,** *See* Lo, C., 6:22303
**Rao, N.A.H.K.,** Fluctuation heat capacity of amorphous $Nb_3Ge$ films, 6:22291
**Rao, T.K.,** Lack of enhancement of chemical mutagenesis by saccharin in the Salmonella assay, 6:22713
**Rapaport, E.,** HeLa cell DNA polymerase α is tightly associated with tryptophanyl-tRNA synthetase and diadenosine 5′,5‴-$P^1$,$P^4$-tetraphosphate binding activities, 6:22614
**Rappaport, P.,** *See* Costello, D., 6:21806
**Rappaz, M.,** Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—, pp 170-184)
*See* Abraham, M.M., 6:21656
*See* Floran, R.J., 6:21658
**Rasmussen, J.O.,** *See* Peker, L.K., 6:22852
**Rasmussen, N.E.,** Effect of electrical-utility-system voltage harmonics on induction motors, 6:21819 (DOE/ET/20279—138)
*See* Jarvinen, P.O., 6:21762
**Rattazzi, G.U.,** *See* Sobotka, L.G., 6:22851
**Raymond, K.N.,** Specific sequestering agents for the actinides, 6:22698
**Reader, J.,** *See* Acquista, N., 6:22347
*See* Wyart, J., 6:22281
**Reagan, D.,** *See* Nowak, J., 6:22502
**Reay, J.,** *See* Hanlon, J., 6:22964
**Rebar, A.H.,** *See* Schnizlein, C.T., 6:22708
**Redford, L.,** Women: the key to a passive solar society, 6:22601
**Ree, F.H.,** *See* Lee, Y.S., 6:22867
**Ree, T.,** *See* Lee, Y.S., 6:22867
**Reed, J.W.,** Project PROPA-GATOR: intermediate range explosion airblast propagation measurements, 6:22526 (SAND—80-1880C)
**Rees, J.R.,** PEP storage ring: current status, 6:22497 (SLAC-PUB—2684)
*See* Olson, C.W., 6:22477
**Reginato, L.L.,** Overview of the ETA/ATA pulse power, 6:22505 (UCRL—83993)
*See* Cook, E.G., 6:22457
**Reiser, M.,** Study of instabilities and emittance growth in periodic focusing systems for intense beams. Progress report, Technical report No. PP 81-198, 6:22467 (DOE/ER/05940—2)
**Renne, D.S.,** *See* Sandusky, W.F., 6:21985
**Rescigno, T.N.,** *See* Hazi, A.U., 6:22808
**Rescoria, A.R.,** Chemical physics of catalysis. Residium upgrading and coking. Chemistry of engine combustion deposits, 6:21582
**Rescorla, A.R.,** Fundamentals of catalytic and thermal reactions. Catalysis for chemicals and fuels. Chemistry of enhanced oil recovery. Sulfur recovery and utilization, 6:21580
**Revis, N.W.,** Association of myocardial cell necrosis with experimental cardiac hypertrophy, 6:22658
**Reynolds, D.A.,** Concepts on integration of physical protection and material accounting functions in a safeguards system, 6:21698 (SAND—81-0495C)
**Reynolds, G.T.,** Applications of image intensification to low level fluorescence studies of living cells, 6:22633
**Reynolds, L.W.,** *See* Mosley, W.C., 6:22517

**Reynolds, S.,** *See* Drury, J.S., 6:22595, 6:22596, 6:22597
**Rhodes, C.K.,** *See* Zavelovich, J., 6:22795
**Rhodes, G.W.,** Second generation ground coupled solar assisted heat pump systems. Six month progress report, 6:21848 (DOE/CS/30224—T1)
**Ribando, R.J.,** *See* Wantland, J.L., 6:22072
**Ricci, P.F.,** Statistical review of cross-sectional studies of ambient air pollution and mortality, 6:22703 (CONF-801045—, pp 65-90)
**Rice, L.G. III,** *See* Smith, G.W., 6:21710
**Rice, W.W.,** *See* Tiee, J.J., 6:22402
**Richard, J.J.,** *See* Spalding, R.F., 6:22583
**Richards, P.L.,** *See* Bailey, R.B., 6:22379
**Richardson, J.H.,** Laser-induced photoelectrochemistry. Time-resolved coulostatic-flash studies of cadmium sulfide electrodes, 6:21797
**Richardson, S.I.,** *See* Walters, A.B., 6:21565
**Richey, J.E.,** Fluxes of organic matter in rivers relative to the global carbon cycle, 6:22567 (CONF-8009140—, pp 270-293)
**Richmann, D.L.,** *See* Kaiser, W.R., 6:21958
**Richter, L.,** Thermal desorption and UPS study of CO adsorbed on Cu-covered Ru (0001), 6:22289
**Ricker, C.W.,** *See* Ragan, G.L., 6:21646
**Rickertsen, L.,** *See* Wilems, R.E., 6:21678
**Riedel, A.A.,** *See* Walko, R.J., 6:21721
**Rielly, T.D.,** Gamma-ray measurements for uranium enrichment standards, 6:22355
**Ring, L.,** *See* Koshel, P., 6:22167
**Ringwood, A.E.,** Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D, 6:21687 (UCRL—15347, pp 46-57)
**Ristinen, R.A.,** *See* Fields, C.A., 6:22845
**Roach, F.,** *See* Martin, S., 6:21894
*See* Robson, W.M., 6:21746
**Robbins, F.V.,** Predicted performance of the KSU solar collector-storage system, 6:21881
**Robbins, W.H.,** *See* Thomas, R.L., 6:21979
**Roberts, A.,** *See* Stenger, V.J., 6:22511
**Roberts, P.C.,** Learning function in nuclear reactor operation and its implications for siting policy, 6:22081 (ORAU/IEA—81-4(M))
**Robinett, K.,** *See* Sawyer, C.H., 6:22212
**Robinson, J.V.,** *See* Platt, A.M., 6:21682
**Robinson, K.,** *See* Winn, C.B., 6:22221
**Robinson, M.G.,** *See* Wise, K.D., 6:22933
**Robinson, W.E.,** *See* Chong, S.L., 6:21614
**Robson, W.M.,** Preliminary market potential indexing study of the United States for direct gain in new single-family residential construction, 6:21746 (LA-UR—81-1201)
**Roche, C.T.,** *See* Brumbach, S.B., 6:21717
**Roczniak, W.R.,** *See* Plumley, A.L., 6:21991
**Rodriguez, J.L.,** *See* Garner, C.M., 6:21774
**Roelofs, L.D.,** Two-dimensional chemisorbed phases, 6:22287
**Rogers, D.W.O.,** Energy-resource requirements of a solar-heating system, 6:21865 (NP—1902600)
**Rogers, E.J.,** Impedance characteristics of large tower footings to a 100/mu/s wide square wave of current, 6:22016
**Rogers, E.M.,** Solar diffusion in California: a pilot study. Consultant report, 6:21737 (DOE/EIA/10189—T1)
**Rogers D.,** *See* Cook, E.G., 6:22457
**Rognstad, R.,** *See* Cohen, S.M., 6:22613
**Rolen, J.J.,** *See* Anderson, P.R., 6:22947
**Rolfe, J.R.,** *See* Butler, H.S., 6:22486
**Rollins, H.R.,** Regulating coal: new approaches for a Reagan administration, 6:22124
**Romanov, Yu.A.,** Electromagnetic waves in a half-space plasma, 6:22864 (ORNL-tr—4750)
**Romero, V.,** *See* Elliott, C.J., 6:22914
**Romig, A.D. Jr.,** Quantitative x-ray microanalysis of U-Nb alloys with the scanning transmission electron microscope, 6:22278 (SAND—81-0147C)
**Ronchetto, J.J.,** Ultrasonic thermometry in oil shale retorts, 6:21612 (UCRL—85845)
**Roothaan, C.C.J.,** General quadratically convergent MCSCF theory in terms of reduced matrix elements, 6:22783 (LBL—12157, pp 77-111)
*See* Detrich, J.H., 6:22752
**Rosa, E.,** *See* Rogers, E.M., 6:21737
**Rosborough, J.R.,** *See* Alvis, R.L., 6:21839
**Rosemary, J.K.,** *See* Sprouse, K.M., 6:21519
**Rosen, H.,** *See* Gundel, L.A., 6:22532
**Rosenbaum, M.,** Experimental and theoretical studies of the effects of nonuniformities in equilibrium magnetohydrodynamic flows, 6:22814
**Rosenblatt, L.S.,** *See* Garsd, A., 6:22656
**Rosenblum, S.S.,** *See* Bistirlich, J.A., 6:22847
*See* Martoff, C.J., 6:22849
**Rosenbusch, J.M.,** *See* Cramer, M.A., 6:21868
**Ross, M.,** *See* Young, D.A., 6:22316
**Ross, P.,** *See* Cairns, E., 6:22092
**Ross, R.,** Performance criteria and test standards for photovoltaic arrays, 6:21831
**Ross, R.G.,** Reference conditions for reporting terrestrial photovoltaic performance, 6:21830
*See* Gonzalez, C.C., 6:21836
**Ross, R.H.,** *See* Drury, J.S., 6:22595, 6:22596, 6:22597
**Rossi, P.,** *See* Prasad, M.K., 6:22842
**Rossiter, W.J. Jr.,** *See* Mathey, R.G., 6:21944
**Roth, J.W.,** *See* Oliver, J.A., 6:22004
**Rothenbacher, H.,** *See* Penman, J.A., 6:22660
**Rothschild, M.,** *See* Zavelovich, J., 6:22795
**Rouse, R.E.,** Massachusetts multi-family passive solar housing program, 6:21913
**Rowe, P.C.,** *See* Bistirlich, J.A., 6:22847
**Rowley, J.K.,** *See* Cleveland, B.T., 6:22736
**Royce, L.,** Energy conservation case study, 9409-13 cooling tower: 9201-5 chiller system, 6:22175 (CONF-8003114—, pp 287-302)
**Rozsa, R.B.,** *See* Tewhey, J.D., 6:21654
**Ruberg, K.,** *See* Gadgil, A., 6:21920
**Rubin, R.M.,** Effects of overburden, biomass and atmospheric inversions on energy and angular distributions of gamma rays from U, K, Th, and airborne radon sources. Final report, 6:21639 (GJBX—141(81))
**Ruccia, F.E.,** Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)
**Ruch, R.R.,** Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979, 6:21538 (DOE/MC/08004—T8)
**Rudzki, J.,** *See* Manning, R., 6:21888
**Ruedenberg, K.,** MCSCF optimization through iterative CI calculations in the single excitation space and MCSCF wave functions in the full reaction space, 6:22781 (LBL—12157, pp 51-57)
**Ruffilli, C.,** *See* Schroeder, R.C., 6:21968
**Ruhe, R.V.,** Clay mineralogy of selected sediments and soils at the Savannah River Plant, Aiken, South Carolina, 6:22729 (DP-MS—80-119)
**Ruhter, W.D.,** *See* Camp, D.C., 6:21647
**Runkle, L.D.,** Progress in the performance of terrestrial solar cell modules, 6:21832
**Ruoff, C.F.,** Continued development of a peat biogasification process, 6:21520
**Rusin, J.M.,** Chemically vapor deposited coatings for multibarrier containment of nuclear wastes, 6:21661 (CONF-8005107—, pp 248-261)
Review of glass ceramic waste forms, 6:21664 (CONF-8005107—, pp 331-354)
**Russell, J.E.,** *See* Hoskins, E.R., 6:21506
**Russell, J.J.,** Photoproduction of charmed baryons, 6:22820
**Russell, M.C.,** Residential photovoltaic system designs, 6:21814 (DOE/ET/20279—123)
Residential photovoltaic power systems for the northeast, 6:21816 (DOE/ET/20279—132)
**Russell, S.J.,** *See* Ruch, R.R., 6:21538
**Russo, P.,** *See* Cowder, L.R., 6:21712
**Ruth, L.A.,** *See* Kowalik, R.M., 6:21998
**Ryabtsev, A.,** *See* Wyart, J., 6:22281
**Rye, R.R.,** *See* Jennison, D.R., 6:22322
**Ryerson, F.J.,** *See* Tewhey, J.D., 6:21654

## S

**Sabersky, A.P.,** Optical beam diagnostics on PEP, 6:22475 (SLAC-PUB—2683)
**Sachs, B.,** Qualitative approach to performance evaluation of passive solar residences, 6:21910
**Sadoway, D.R.,** *See* Flemings, M.C., 6:22267
**Sager, P.H.,** ETF reactor design status, 6:22925
**Saguinsin, J.L.S.,** Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Said, N.,** *See* Krishnaswamy, S.V., 6:22286
**Salamandra, J.,** State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980, 6:21586 (DOE/EIA/10221—T2)

**Salazar, G.,** *See* Hanlon, J., 6:22964
**Salvador, L.A.,** Westinghouse coal gasification system, 6:21532
**Salzano, F.M.,** *See* Mohrenweiser, H., 6:22640
**Sampson, T.E.,** Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
*See* Sprinkle, J.K. Jr., 6:22350
**Samsa, M.,** *See* Wolsko, T., 6:21811
**Samuelson, L.E.,** *See* Fields, C.A., 6:22845
**San Sebastian, J.R.,** *See* Hsie, A.W., 6:22715
**Sanborn, J.B.,** *See* Gordon, D.M., 6:21699
**Sandell, N.R. Jr.,** *See* Lehtomaki, N.A., 6:22022
**Sanders, D.M.,** *See* Haller, W., 6:22305
**Sanderson, J.E.,** *See* Ruoff, C.F., 6:21520
**Sandorfi, A.M.,** Evidence for giant E2 transitions in high-energy a-particle capture, 6:22848
**Sandstrom, D.J.,** *See* Merrigan, M.A., 6:22423
**Sandusky, W.F.,** Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**Sani, R.L.,** Solution of the time-dependent incompressible Navier-Stokes equations via a penalty Galerkin finite element method, 6:22445 (UCRL—85354)
*See* Gresho, P.M., 6:22446
**Santini, D.J.,** Construction-employment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities, 6:22100 (ANL/CNSV—19)
**Santore, R.R.,** *See* Lewis, R., 6:21529
**Sapienza, R.,** *See* Gaffney, J., 6:22260
**Sarkinen, S.H.,** *See* Chartier, V.L., 6:22015
**Sass, J.H.,** Heat flow in relation to hydrothermal activity in the southern Black Rock Desert, Nevada, 6:21964 (USGS-OFR—79-1467)
**Sathyanarayana, K.,** *See* Jones, M.S. Jr., 6:22150
**Satman, A.,** In-situ combustion models for the steam plateau and for fieldwide oil recovery, 6:21570 (DOE/ET/12056—11)
**Satoh, K.,** *See* Wilson, P.B., 6:22476
**Saunders, W.J.,** *See* Miller, C.W., 6:22645
**Sauthoff, N.R.,** *See* Suckewer, S., 6:22886
**Sawyer, C.H.,** Analysis of institutional issues in the implementation of Federal energy-performance standards for new buildings, 6:22212 (PNL—3312)
**Sawyer, D.,** *See* McCormick, J., 6:21769
**Sawyer, R.F.,** *See* Pitz, W.J., 6:22416
**Saxe, P.,** Methylene singlet-triplet separation: an explicit variational treatment of many-body correlation effects, 6:22383
**Saxman, A.C.,** *See* Day, R.D., 6:22915
**Scaiano, J.C.,** *See* Encinas, M.V., 6:22403
**Scandora, A.E. Jr.,** *See* Taylor, J., 6:22619
**Schade, H.E.,** *See* Carlson, D.E., 6:21791
**Schaefer, H.F. III,** *See* Laidig, W.D., 6:22779
*See* Saxe, P., 6:22383
**Schaffer, W.J.,** *See* Zehr, S.W., 6:21801
**Schatzle, P.R.,** *See* Curry, W.H., 6:22427
**Schechter, R.S.,** *See* Nunn, C.C., 6:21579
**Scheetz, B.E.,** Hydrothermal interaction of a ceramic waste form with basalt, 6:22294 (CONF-8005107—, pp 44-57)
**Schenley, R.L.,** *See* O'Neill, J.P., 6:22714
**Schipper, L.,** Progress in residential energy conservation: a multi country perspective, 6:22206 (LBL—11701)
**Schirber, J.E.,** Pressure-induced change in the Fermi surface and electronic structure of metals, 6:22279 (SAND—81-0558C)
**Schmid, B.K.,** *See* Jackson, D.M., 6:21525
**Schmidly, D.J.,** Marine mammals of the Southeastern United States coast and the Gulf of Mexico, 6:22572 (FWS/OBS—80/41)
**Schmidt, D.P.,** Linear oil displacement by the emulsion entrapment process, 6:21577
**Schmidt, G.D.,** *See* Hazen, T.C., 6:22659
**Schmidt, G.F.,** Alkyl-metal and aryl-metal bond chemistry in coordinately unsaturated polynuclear metal complexes, 6:22371
**Schmidt, J.A.,** *See* Cook, E.G., 6:22457
**Schmidt, J.E.,** Status of the CRBRP steam-generator design, 6:22031 (CONF-810615—2)
**Schmidt, L.C.,** *See* Liebenberg, D.H., 6:22312
**Schmidt, W.B.,** The US Department of Energy's coal mining research, 6:21554
**Schmitt, R.C.,** Agriculture, greenhouse, wetland and other beneficial uses of geothermal fluids and heat, 6:21976 (CONF-810471—1)
**Schneider, S.J.,** High temperature applications of structural ceramics. Quarterly progress report, January-March 1981, 6:22296 (DOE/OR/20679—T4)
**Schneider, U.A.,** Development of automated welding process for field fabrication of thick walled pressure vessels. Second quarterly report, FY 1981, 6:22051 (DOE/OR/13511—T1)
**Schnizlein, C.T.,** Effect of lung damage by acute exposure to nitrogen dioxide on lung immunity in the rat, 6:22708
**Schoenberg, K.F.,** Spontaneous ion-acoustic generation in a high power, multifilament ion source, 6:22889
**Schrandt, R.G.,** *See* Eccleston, G.W., 6:21690
**Schreiner, M.,** *See* Kuo, J., 6:21527
**Schrider, L.A.,** *See* Martin, J.W., 6:21522
**Schroeder, R.C.,** Reinjection studies of vapor-dominated systems, 6:21968 (LBL—12175)
**Schueler, D.G.,** Overview: recent developments and potential of photovoltaic concentrating collectors, 6:21779 (SAND—81-1222C)
*See* Post, H.N., 6:21824
**Schuenemeyer, J.H.,** Analysis of a statistical model to predict future oil, 6:21568 (CONF-791016—, pp 223-225)
**Schulte, D.D.,** *See* DeShazer, J.A., 6:21882
**Schwager, F.,** *See* Geronov, Y., 6:22090
**Schwartz, L.H.,** *See* Amelse, J.A. Hill, 6:22370
**Schwartz, M.W.,** Safety of isotropic flywheels, 6:22087 (UCRL—84347)
**Schwartz, S.E.,** *See* Lee, Y.N., 6:22369
**Schwarz, H.,** *See* Allen, M.A., 6:22471
*See* Pellegrin, J.L., 6:22493
**Schweitzer, D.J.,** *See* Benjamin, S.A., 6:22690
**Schweitzer, M.,** Link between traditional planning and energy management, 6:22112 (CONF-810140—1)
**Scott, D.D.,** *See* Goris, P., 6:22026
**Scott, L.A.,** Indoor air pollution in passive structures, 6:21902
*See* Anderson, P.R., 6:22947
**Scott, M.G.,** *See* Scott, L.A., 6:21902
**Scott, R.A.,** Extended x-ray absorption fine structure of copper in cytochrome c oxidase: direct evidence for copper-sulfur ligation, 6:22390
**Scott, W.,** *See* Taylor, R.V., 6:22747
**Scudder, J.K.,** *See* Brooks, A.L., 6:22430
*See* Hawke, R.S., 6:22429
**Sears, D.R.,** *See* Honea, F.I., 6:21563
**Sebald, A.V.,** Eliminating peak load auxiliary energy use in passive solar residences during winter, 6:21924
**Sedrick, V.,** *See* Keller, B.M., 6:21899
**Segel, G.B.,** Lymphocyte sodium concentration regulates monovalent cation transport after PHA stimulation, 6:22643
*See* Lichtman, A., 6:22644
**Seger, G.,** *See* Mullaney, P.F., 6:22630
**Seitz, M.G.,** Influence of waste solid on nuclide dispersal, 6:21662 (CONF-8005107—, pp 287-296)
**Selan, J.C.,** Technical evaluation of the adequacy of station electric distribution system voltages for the Yankee Rowe Nuclear Power Station, 6:22028 (UCI—18966)
**Self, S.A.,** *See* Eustis, R.H., 6:22144
**Selig, W.,** Critical examination of the salicylaldehyde method for the determination of primary amines in the presence of secondary amines, 6:22628
**Seliger, H.H.,** *See* Hamman, J.P., 6:22615
*See* Tyler, M.A., 6:22609
**Seligman, T.H.,** Group theory and its applications in physics, 1980, 6:22876
**Selk, R.,** *See* Lyons, P.B., 6:22879
**Selkirk, J.K.,** Chemical carcinogenesis. Chapter 12, 6:22717
**Sellin, I.A.,** Charge transfer to the continuum by heavy ions in atomic hydrogen, 6:22769 (CONF-810432—3)
**Selph, F.,** *See* Pines, H., 6:22468
**Senseny, P.E.,** *See* Pfiefle, T.W., 6:22731
**Senterfit, R.M.,** *See* Long, C.L., 6:21963
**Serebryakov, V.N.,** *See* Gel'perin, N.I., 6:22360
**Seskus, A.P.,** *See* Pulle, C.V., 6:21597
**Sevilla, M.D.,** ESR study of DNA base cation radicals produced by attack of oxidizing radicals, 6:22405
ESR study of electron reactions with carboxylic acids, ketones, and aldehydes in aqueous glasses, 6:22399
ESR study of electron reactions with esters and triglycerides, 6:22400
Mechanisms for radiation damage in DNA. Progress report, January 1, 1980-December 31, 1980, 6:22673 (DOE/EV/02364—T1)
**Sexton, F.W.,** *See* Garner, C.M., 6:21774
**Sgro, A.G.,** Simulation of the formation of the PS-1 spheromak, 6:22898
**Shaeffer, D.L.,** *See* Herbes, S.E., 6:22584
**Shafer, B.D.,** Photovoltaic concentrator development, 6:21829
*See* Boes, E.C., 6:21778
*See* Stillwell, C.B., 6:21777
**Shah, V.L.,** *See* Lee, W.H., 6:22080
**Shain, T.W.,** *See* Price, T.W., 6:22261

**Shamma, S.E.,** *See* Rosenbaum, M., 6:22814
**Shamoo, A.E.,** *See* Abramson, J.J., 6:22627
**Shampine, L.F.,** Type-insensitive ODE codes based on implicit A-stable formulas, 6:22968
**Shanahan, W.R.,** Characterization and suppression of zero-frequency cyclotron waves on relativistic electron beams, 6:22479
Simulation of slow cyclotron wave growth on a scattered relativistic electron beam, 6:22806
**Shanks, D.,** *See* Diachok, D., 6:21923
**Shann, S.H.,** Stress corrosion cracking of zircaloy by metal iodides and cadmium, 6:22274 (LBL—12548, pp 1-5)
**Shannon, R.F.,** Bottom line: comments on incremental costs in the Massachusetts multi-family passive solar housing program, 6:21903
*See* Rouse, R.E., 6:21913
**Shapiro, A.,** *See* Amelse, J.A. Hill, 6:22370
**Shapiro, S.L.,** *See* Feldman, B.J., 6:22435
**Shapiro, S.M.,** *See* Sinha, S.K., 6:22318
**Shapiro, T.,** Co-generation, 6:22236 (CONF-8003114—, pp 463-474)
**Sharp, C.B.,** *See* Anderson, D.V., 6:22888
**Sharp, D.J.,** *See* Mullendore, A.W., 6:22957
**Sharp, K.,** *See* McCormick, J., 6:21769
**Shaw, R.W.,** *See* Scott, R.A., 6:22390
**Sheaff, M.,** *See* Cox, P.T., 6:22818
*See* Wilkinson, C., 6:22821
**Shek, M.L.,** Surface segregation and surface electronic structure of PtCu alloys: Dependence on atomic coordination, 6:22288
**Shell, P.K.,** *See* Krikorian, O.H., 6:21722
**Shelnutt, J.A.,** Simple interpretation of Raman excitation spectra of metalloporphyrins, 6:22338
**Shelton, R.L.,** Guidelines and input requirements for submitting energy management projects to DOE, 6:22115 (CONF-8003114—, pp 147-153)
**Shen, S.,** Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils, 6:21999 (DOE/ET/12292—T1)
**Shepard, N.F. Jr.,** Low-cost, actively-cooled linear photovoltaic receiver, 6:21780 (SAND—81-7113C)
**Shepard, R.,** Formal and numerical convergence comparison of SCI and exponential methods, 6:22785 (LBL—12157, pp 121-122)
Recent developments in multiconfiguration wavefunction optimization, 6:22784 (LBL—12157, pp 117-120)
**Shepherd, C.,** *See* Brodie, I., 6:22155, 6:22156
**Sherf, D.B.,** *See* Farnham, R.S., 6:21553
**Sherman, D.,** Release of water vapor from uranium dioxide, 6:22300 (LBL—12548, pp 41-46)
**Shermann, R.H.,** *See* Bistirlich, J.A., 6:22847
**Sherwood, K.W.,** *See* Kool, L.B., 6:22942
**Shetty, D.K.,** *See* Wright, I.G., 6:21497
**Shields, K.A.,** *See* Angleton, G.M., 6:22675
**Shintoni, T.,** *See* Eyssa, Y.M., 6:22085
**Shipley, J.P.,** Evolution of safeguards systems design, 6:21714
*See* Hakkila, E.A., 6:21715
**Shirane, G.,** *See* Endoh, Y., 6:22319
*See* Thomlinson, W., 6:22317
**Shively, F.T.,** *See* Bistirlich, J.A., 6:22847
**Shope, L.A.,** *See* Berg, R.S., 6:22809
**Shore, B.W.,** Effect of propagation of coherent pulses on multiple-photon excitation, 6:22789 (UCRL—83764)
**Shulman, R.G.,** *See* Cohen, S.M., 6:22613
**Shultz-McKinley, S.,** Chemical, physical, and mineralogical characterization of fifteen sandstones for radionuclide sorption studies, 6:21686 (UCID—19034)
**Shunk, E.R.,** *See* Hsu, H.H., 6:22328
*See* Moss, C.E., 6:21697
**Siegel, M.D.,** Simplified design methods for photovoltaic systems, 6:21828
**Siegrist, J.L.,** *See* Donald, M.H.R., 6:22470
**Siekhaus, W.J.,** *See* Buckingham, A.C., 6:22443
**Silverman, J.,** *See* Combs, L.P., 6:21523
**Simmons, M.K.,** *See* Hollander, J.M., 6:22122
**Simmons, R.D.,** *See* Lyons, P.B., 6:22879
**Simms, R.J.,** "Vacuum" layer double-shell cryogenic inertial fusion targets, 6:22943
**Simoes, A.L.,** *See* Mohrenweiser, H., 6:22640
**Simons, D.J.,** *See* Fitzgerald, T.J., 6:22743
**Simons, G.A.,** Effects of preignition on pulverized-coal combustion. Second quarterly report, 1 January 1981-31 March 1981, 6:21562 (DOE/PC/30293—2)
**Simons, J.,** *See* Shepard, R., 6:22785
**Simons, M.,** *See* Bedair, S.M., 6:21802
**Simpkin, A.J.,** High mass flux gasifier, 6:21533
**Sincali, A.J.,** *See* Irwin, C.F., 6:21514
**Sing, C.F.,** *See* Annest, J.L., 6:22641
**Singer, R.M.,** Studies of thermal-hydraulic phenomena in EBR-II, 6:22063
**Singh, K.N.,** Spent-fuel dry-storage-concept evaluation, 6:21683 (RHO-CD—972)
**Singh, L.P.S.,** Covariant propagators for massive arbitrary-spin fields, 6:22836
**Singh, R.P.,** *See* Alonso, J.R., 6:22491
**Singh, V.,** *See* Pasupathy, J., 6:22823
**Singleton, R.M.,** Microradiographic characterization of metal and polymer coated microspheres, 6:22946
**Sinha, A.,** *See* Prasad, M.K., 6:22839
**Sinha, S.K.,** Neutron scattering investigation of the phase transitons in uranium arsenide, 6:22318
**Sinton, S.,** Study of liquid crystal conformation by multiple quantum NMR: n-pentyl cyanobiphenyl, 6:22391
**Siukola, L.V.M.,** *See* Antypas, W.G. Jr., 6:22385
**Sivasubramanian, R.,** *See* Ying, D.H.S., 6:21498
**Skeath, P.R.,** *See* Su, C.Y., 6:22323
**Skinner, D.M.,** *See* Christie, N.T., 6:22639
**Sklarew, D.S.,** *See* Toste, A.P., 6:21516
**Skodje, R.T.,** Parabolic tunneling calculations, 6:22810
**Skubic, P.,** *See* Cox, P.T., 6:22818
**Slack, D.S.,** *See* VanSant, J.H., 6:22954
**Slaga, T.,** *See* Huberman, E., 6:22616
**Slaga, T.J.,** *See* Nesnow, S., 6:22702
**Slaughter, G.G.,** *See* Ragan, G.L., 6:21646
**Small, R.D.,** *See* Stine, R.A., 6:22224
**Smalley, R.E.,** *See* Dietz, T.G., 6:22280
*See* Powers, D.E., 6:22797
**Smathers, D.C.,** Tamper recorder for unattended safeguards instruments, 6:21705
**Smith, D.H.,** *See* Walker, R.L., 6:22358
*See* Walton, J.R., 6:21693
**Smith, D.K.,** *See* Scheetz, B.E., 6:22294
**Smith, F.W.,** Critical conditions for the growth of SiC, $Si_3N_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981, 6:22295 (DOE/ER/10438—T1)
**Smith, G.S.,** Inventory verification methods in DOE safeguards inspections, 6:21704
**Smith, G.W.,** Active neutron technique for detecting attempted special nuclear materials diversion, 6:21710
**Smith, H.,** Radiation and electrical safety systems for PEP, 6:22494 (SLAC-PUB—2675)
**Smith, J.,** *See* deGrassie, J.S., 6:22927
**Smith, J.N. Jr.,** Auger analysis of surface deposits formed by exposure to plasma discharges in Doublet III, 6:22900
**Smith, K.L. Jr.,** *See* Gomez, L.S., 6:21685
**Smith, P.A.,** *See* Fields, C.A., 6:22845
**Smith, R.B.,** *See* Swartzbaugh, J.T., 6:22256
**Smith, R.D.,** Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**Smith, R.T.,** Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
**Smith, W.L.,** *See* Raymond, K.N., 6:22698
**Snipes, M.B.,** Retention of microspheres in the rat lung after intratracheal instillation, 6:22706
**Snipes, W.,** *See* DeLuca, N., 6:22652
**Snyder, M.K.,** *See* Aronson, S.J., 6:21849
*See* Lindsey, L.L., 6:21850
**Snyder, R.,** *See* Hayes, J., 6:21885
**Sobotka, L.G.,** Rigid rotation and l-wave fractionation in the deep-inelastic reaction: 664 MeV $^{84}$Kr+/sup nat/Ag, 6:22851
**Soderholm, L.H.,** Wind energy for agricultural heating, 6:21990
**Sofen, S.R.,** *See* Raymond, K.N., 6:22698
**Solbrig, C.W.,** *See* Chen, T.H., 6:22074
**Solman, F.J.,** Operating experience with the natural bridges national monument photovoltaic power system, 6:21818 (DOE/ET/20279—135)
**Solway, A.,** *See* Harding, C.V., 6:22647
**Soo, H.,** *See* Schmidt, D.P., 6:21577
**Sopori, B.L.,** Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells. Quarterly technical progress report No. 2, 1 November 1980-31 January 1981, 6:21788 (SERI/PR—9234-2-T1)
**Southworth, G.R.,** *See* Herbes, S.E., 6:22584
**Spalding, R.F.,** Water: pesticides in ground water beneath irrigated farmland in Nebraska, August 1978, 6:22583
**Spence, D.,** *See* Dillon, M.A., 6:22800
**Spencer, D.W.,** Seasonal variation in the solar spectrum, 6:21743
**Spencer, J.E.,** Wigglers: the newest profession, 6:22495 (SLAC-PUB—2677)
*See* Brown, K.L., 6:22474

**Spencer, N.,** *See* Donald, M.H.R., 6:22470
**Spicer, W.E.,** *See* Shek, M.L., 6:22288
*See* Su, C.Y., 6:22323
**Spiker, E.C.,** Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries, 6:22562 (CONF-8009140—, pp 75-108)
**Spillman, C.K.,** *See* Robbins, F.V., 6:21881
**Spindt, C.A.,** *See* Brodie, I., 6:22156
**Sprinkle, J.K.,** *See* Cowder, L.R., 6:21712
**Sprinkle, J.K. Jr.,** In-plant evaluation of a uranium NDA system, 6:22350
**Sprouse, K.M.,** CS/R Advanced Peat Hydrogasification Process, 6:21519
**Sriner, D.S.,** *See* McLaughlin, S.B., 6:22712
**Staats, E.B.,** Improved data and procedures needed for development and implementation of building energy performance standards, 6:22204 (EMD—81-2)
**Staebler, D.L.,** *See* Carlson, D.E., 6:21791
**Staiger, P.J.,** Performance calculations for 200-1000 MWe MHD/steam power plants, 6:22151 (DOE/NASA/10769—16)
**Stallings, T.L.,** Formulation of PBX 9503, 6:22525 (MHSMP—81-25)
**Stattel, P.,** *See* Foerster, C.L., 6:22507
**Stauter, R.C.,** *See* Erbs, D.G., 6:21745
**Stav, R.,** *See* deGrassie, J.S., 6:22927
**Stearns, R.D.,** *See* Chartier, V.L., 6:22015
**Steele, J.D.,** *See* Ruch, R.R., 6:21538
**Steen, W.C.,** *See* Baughman, G.L., 6:22591
**Steenhoek, L.E.,** Spatial mapping of concentrations in pulsed and continuous atom sources, 6:22401
**Stefan, P.M.,** *See* Shek, M.L., 6:22288
**Steigerwald, R.L.,** Two-quadrant transistor chopper for electric vehicle drive, 6:22262
**Stein, C.,** *See* Stein, R.G., 6:22190
**Stein, R.G.,** Handbook of energy use for building construction, 6:22190 (DOE/CE/20220—1)
**Steinbruechel, C.,** Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**Steindler, M.J.,** *See* Seitz, M.G., 6:21662
**Stenberg, V.I.,** *See* Baltisberger, R.J., 6:21502
**Stenger, V.J.,** Angular and energy resolution of the DUMAND optical array, 6:22511 (DOE/ER/00511—T1)
**Stephens, L.C.,** Atrophic thyroiditis in long-term Segment III beagles, 6:22679 (FDA—81-8042, pp 45-55)
Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age, 6:22677 (FDA—81-8042, pp 27-39)
Thyroid neoplasia in long-term Segment III beagles, 6:22680 (FDA—81-8042, pp 56-63)
*See* Benjamin, S.A., 6:22678, 6:22681
*See* Bishop, L., 6:22676
*See* Brewster, R.D., 6:22686, 6:22692
*See* Miller, C.W., 6:22645
**Stevens, P.,** *See* Wilems, R.E., 6:21678
**Stevenson, T.T.,** Osmoregulation in the Avena coleoptile in relation to auxin and growth, 6:22662
**Steward, S.A.,** *See* Lakner, J.F., 6:22375
**Steward, W.F.,** Investigation of liquid hydrogen as a vehicular fuel, 6:21724
**Stewart, L.,** Input parameters for LEAP and analysis of the Model 22C data base, 6:22120 (ORNL—5746)
**Stieff, L.R.,** Preliminary study of the transport and distribution of radium, radon and their alpha-emitting daughters using nuclear emulsions and polonium-210. Final report, 6:21640 (GJBX—144(81))
**Stiles, A.B.,** *See* Katzer, J.R., 6:21494
**Stillwell, C.B.,** Compatibility of Fresnel lenses and photovoltaic cells in concentrator modules, 6:21777 (SAND—81-1191C)
**Stine, R.A.,** Some factors influencing estimators in motor gasoline demand models, 6:22224 (CONF-801045—, pp 91-101)
**Stinton, D.P.,** *See* Angelini, P., 6:21660
**Stocker, P.J.,** *See* Zehr, S.W., 6:21801
**Stoenner, R.W.,** *See* Fireman, E.L., 6:22737
**Stokely, J.R.,** Nuclear and radiochemical analysis, 6:22335 (ORNL—5738, pp 81-95)
**Stokstad, R.G.,** *See* Myers, W.D., 6:22844
**Stoltz, D.R.,** *See* Rao, T.K., 6:22713
**Storch, J.,** *See* Hoffert, M.I., 6:22534
**Storm, G.L.,** *See* Penman, J.A., 6:22660
**Stout, B.A.,** *See* Myers, C.A., 6:22246
**Stout, J.D.,** *See* O'Brien, B.J., 6:22555
**Stout, J.W.,** Summary of the hydraulic evaluation of LWBR (LWBR development program), 6:22042 (WAPD-TM—1386)
*See* Lerner, S., 6:22041
**Stout, L.A.,** *See* Miller, F.A., 6:21680
**Strakey, J.P.,** *See* Lewis, R., 6:21529
**Strand, R.H.,** *See* Farrell, M.P., 6:22540
**Strassner, G.,** *See* Martoff, C.J., 6:22849
**Strauss, H.R.,** Limiting beta of stellarators with no net current, 6:22897
**Streets, D.G.,** Air quality analysis of Phase I of the proposed oil backout legislation, 6:21540 (ANL/EES-TM—130)
Air quality analysis of Phase I of the proposed oil backout legislation: Introduction, 6:22229 (ANL/EES-TM—130, pp 1-9)
Assessment of the proposed legislation, 6:22553 (ANL/EES-TM—130, pp 66-75)
Estimated ambient $SO_2$ and $SO_4$ impacts, 6:22536 (ANL/EES-TM—130, pp 26-40)
Regional and national $SO_2$ emissions, 6:21541 (ANL/EES-TM—130, pp 10-25)
Regional and national $SO_2$ control costs, 6:22464 (ANL/EES-TM—130, pp 51-65)
Regional and national NO/sub x/ emissions, 6:22537 (ANL/EES-TM—130, pp 41-50)
*See* Garvey, D.B., 6:22535
**Streitwieser, A. Jr.,** *See* Luke, W.D., 6:22411
**Strindell, L.,** *See* Doe, T., 6:21673
**Strong, S.J.,** Flat plate combined photovoltaic/thermal energy system, 6:21827
*See* Nichols, B.E., 6:21817
**Strottman, D.,** *See* Nix, J.R., 6:22854
**Stuckwish, D.N.,** *See* Bjornstad, D.J., 6:22121
**Stucky, G.D.,** *See* Jennison, D.R., 6:22322
**Studley, R.V.,** NDA for the SRP fuel fabrication process, 6:21706
**Su, C.Y.,** Oxidation of Si(111), 7 x 7 and 2 x 1: A comparison, 6:22323
**Sucher, J.,** Quantum electrodynamics and the relativistic theory of many-electron atoms, 6:22749 (ANL—80-126, pp 1-26)
**Suckewer, S.,** Toroidal plasma rotation in the PLT tokamak with neutral-beam injection, 6:22886 (PPPL—1792)
**Sudan, R.N.,** Generation and focusing of pulsed intense ion beams. Final progress report, April 1, 1979-September 30, 1979, 6:22909 (DOE/DP/40012—T1)
**Sudarshan, E.C.G.,** Constraint dynamics of particle world lines, 6:22870
*See* Mukunda, N., 6:22868, 6:22869
**Sudbury, J.D.,** Gasification of caking coals in the BGC/Lurgi slagging gasifier--a status report., 6:21534
**Sugama, T.,** Catalytic effect of a Portland cement filler on the cure of water-compatible resorcinol phenol-formaldehyde polymer concrete, 6:22307
**Sullivan, J.E.,** *See* Singer, R.M., 6:22063
**Sullivan, P.,** F-Chart/SLR: an interactive program for determining the performance of active and passive solar buildings, 6:21926
**Sullivan, R.F.,** Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, January-March 1981, 6:21493 (DOE/ET/10532—T1)
**Sullo, P.,** Energy R and D in the private sector, 6:22105 (CONF-791016—, pp 94-96)
**Summers, S.T.,** *See* Kalbalka, G.W., 6:22386
**Suryanarayana, D.,** *See* Sevilla, M.D., 6:22405
**Susan, S.,** *See* Harding, C.V., 6:22636, 6:22647, 6:22669
**Swadley, W.C.,** *See* Hoover, D.L., 6:22722
**Swann, T.,** Opto-mechanical devices for the Antares automatic beam alignment system, 6:22913 (LA-UR—81-1229)
**Swansen, J.,** *See* Lee, D.M., 6:21716
**Swarts, S.,** *See* Sevilla, M.D., 6:22399, 6:22400
**Swartzbaugh, J.T.,** Evaluation of mixing systems for biogasification of municipal solid waste, 6:22256 (DOE/CS/20100—T2)
**Sweatt, W.C.,** *See* Day, R.D., 6:22915
**Swegle, J.,** Instability of the Brillouin-flow equilibrium in magnetically insulated structures, 6:22901
**Swift, H.F.,** 150mm launcher facility for shockwave compression experiments: a critical review and conceptual design study, 6:22527 (UCRL—15334)
**Sykes, R.M.,** Full scale field demonstration of unheated anaerobic contact stabilization. Project status report, October 1980-February 1981, 6:21726 (DOE/CS/24310—3)
**Szekely, J.,** *See* Flemings, M.C., 6:22267
**Szymborski, J.,** Development of a totally maintenance-free, deep-discharge lead-acid battery for photovoltaic applications, 6:22095 (SAND—81-7119C)

## T

**Taber, J.J.,** *See* Orr, F.M. Jr., 6:21571
**Talty, R.D.,** *See* Honea, F.I., 6:21563
**Talwar, R.,** Swimming pool heating, 6:21914
**Tam, K.C.,** Tomographical imaging with limited-angle input, 6:22872
**Tang, A.,** Mathematical modeling and control of the coke making process, 6:21490 (CONF-810473—1)

**Tang, W.M.,** *See* Horton, W. Jr., 6:22892
**Tanzman, E.,** *See* Wolsko, T., 6:21811
**Tao, J.C.,** *See* Tsao, T.R., 6:21512
**Taran, A.L.,** *See* Gel'perin, N.I., 6:22360
**Tarrer, A.R.,** *See* Garg, D., 6:21499, 6:21500
**Taylor, G.N.,** *See* Stenger, V.J., 6:22511
**Taylor, J.,** Estimation of two-dimensional electrophoretic spot intensities and positions by modeling, 6:22619
**Taylor, R.V.,** Matrix interactions with rare-gas oxide excimers, 6:22747
**Taylor, S.L.,** Assessment of air solar system performance with alternate methods of analysis, 6:21872 (SOLAR/0005—81/80, pp 45-57)
**Taylor, T.,** *See* deGrassie, J.S., 6:22927
*See* Smith, H., 6:22494
**Tehranian, F.,** Study of the kinetics of UC vaporization at temperatures above melting point using laser heating technique, 6:22299 (LBL—12548, pp 35-40)
**Tekawa, M.,** *See* Lothrop, F., 6:22490
**Templeton, D.H.,** Anomalous scattering of X-rays by cesium and cobalt measured with synchrotron radiation, 6:22857
**Templeton, L.K.,** *See* Templeton, D.H., 6:22857
**Templeton, S.,** *See* Jackiw, R., 6:22827
**Ternoey, S.E.,** *See* Kurkowski, T.L., 6:21895
**Tewhey, J.D.,** Application of SYNROC to high-level defense wastes, 6:21654 (CONF-8005107—, pp 4-24)
**Thayer, P.A.,** Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
**Thiagarajan, V.,** *See* Jones, M.S. Jr., 6:22150
**Thode, E.F.,** Multistage leaching of spent modified in situ oil shale retorts, 6:21609 (LA—8744-MS)
**Thode, L.E.,** *See* Guiragossian, Z.G.T., 6:22917
**Thomas, C.C. Jr.,** Materials measurement and accounting in an operating plutonium conversion and purification process. Phase I. Process modeling and simulation, 6:21694 (LA—8809-MS)
**Thomas, J.,** *See* Ruch, R.R., 6:21538
**Thomas, J.K.,** *See* Bakale, G., 6:22406
**Thomas, N.L.,** Angular measurements in optical testing, 6:22431 (UCRL—84968)
**Thomas, R.K.,** *See* Gartling, D.K., 6:21684
**Thomas, R.L.,** Large wind turbines: early operational experience and potential for supplying electricity, 6:21979
**Thomlinson, W.,** Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Thompson, L.F.,** *See* Ford, C.D., 6:21613
**Thompson, L.J.,** *See* Averback, E.S., 6:22272
**Thompson, M.C.,** *See* Mosley, W.C., 6:22517
**Thompson, M.D.,** *See* Vahle, M.O., 6:22976
**Thompson, T.L.,** *See* Peck, J., 6:21905
**Thorhaug, A.,** Greater Caribbean Energy and Environment Future. Ad hoc working group report, Key Biscayne, Florida, October 26-28, 1980, 6:22104 (DOE/EV/10454—T1)
**Thornhill, J.W.,** *See* Costogue, E.N., 6:21800
*See* Ferber, R.R., 6:21834
**Thornton, J.A.,** *See* Jonath, A.D., 6:21789
**Thorpe, M.F.,** *See* Endoh, Y., 6:22319
**Tibbets, G.A.,** Program for the improvement of downhole drilling motor bearings and seals. Phase IV. Final report, 6:21973 (SAND—81-7066)
**Tibbetts, G.,** Distillate price-monitoring system. Final report, 6:21583 (DOE/EIA/06278—T1)
**Tichenor, D.A.,** *See* Wang, J.C.F., 6:22282
**Tiedje, J.M.,** Nitrilotriacetate: hindsight and gunsight, 6:22592
**Tiee, J.J.,** Ultraviolet laser photochemistry of $CF_2Cl_2$, 6:22402
**Tilford, C.R.,** *See* McCulloh, K.E., 6:22449
**Timmons, M.L.,** *See* Bedair, S.M., 6:21802
**Tisdale, M.,** *See* Cohen, A.D., 6:21550
**Tobias, C.,** *See* Cairns, E., 6:22092
**Tobiasen, C.,** *See* Martner, B.E., 6:21982
**Tochiyama, O.,** Mixed ligand chelate extraction of lanthanides with 5,7-dibromo-8-quinolinol systems, 6:22344
**Tokar, J.V.,** *See* Singer, R.M., 6:22063
**Tolendino, L.F.,** *See* Vahle, M.O., 6:22976
**Tollaksen, S.L.,** Two-dimensional electrophoresis of human urinary proteins in health and disease, 6:22624
**Tolley, H.D.,** Adjusting survival data for covariates, 6:22541 (CONF-801045—, pp 201-205)
**Tomlinson, J.J.,** *See* Martin, J.F., 6:22088
**Toney, B.C.,** *See* Ford, W.E. III, 6:22099
**Tongson, L.L.,** *See* Krishnaswamy, S.V., 6:22286
**Toor, I.A.,** *See* Yarbrough, D.W., 6:22210
**Tosa, Y.,** How unique are SU(5) and SO(10) grand unified theories?, 6:22832
**Toste, A.P.,** Comparison of chemical and mutagenic properties of a coal liquid and a shale oil, 6:21516 (PNL-SA—8812)
**Towle, S.,** *See* Sachs, B., 6:21910
**Towner, H.H.,** *See* Suckewer, S., 6:22886
**Trahey, N.M.,** *See* Voeks, A.M., 6:21702
**Trainor, T.A.,** Improved two-loop beam energy stabilizer for an FN tandem accelerator, 6:22482 (DOE/ER/01388—489)
Investigation of periodic acceleration tube discharges with a capacitive pickup array, 6:22466 (DOE/ER/01388—488)
**Treleven, K.,** Suncatcher monitoring project. Semi-annual technical report, July-December 1980, 6:21846 (DOE/CS/30169—6)
**Tripathi, G.N.R.,** Resonance Raman scattering of semiquinone radical anions, 6:22798
**Triplett, L.L.,** *See* Nesnow, S., 6:22702
**Truett, T.,** Proceedings of the 1980 DOE statistical symposium, 6:22538 (CONF-801045—)
**Truett T.,** *See* Gardiner, D.A., 6:21619
**Truher, J.B.,** *See* Clendenin, J.E., 6:22500
**Truhlar, D.G.,** *See* Blais, N.C., 6:22794
*See* Skodje, R.T., 6:22810
**Truoel, P.,** *See* Martoff, C.J., 6:22849
**Tsai, C.H.,** Kinetics of laser pulse vaporization of $UO_2$, 6:22298 (LBL—12548, pp 20-34)
**Tsai, Y.H.,** *See* Saguinsin, J.L.S., 6:22723
**Tsang, Y.W.,** *See* Witherspoon, P.A., 6:22730
**Tsao, T.R.,** Acid gas removal and cryogenic separation of SNG produced from coal, 6:21512
**Tsaros, C.L.,** *See* Punwani, D.V., 6:21531
**Tsong, T.T.,** *See* Krishnaswamy, S.V., 6:22325
**Tully, G.F.,** *See* Ingersoll, T.G., 6:21898
**Turechek, J.J.,** Spectroscopic study of stimulated Brillouin scattering, 6:22896
**Turekian, K.K.,** Radiocarbon in New York Bight sediments and the use of carbon isotopes in delineating carbon sources, 6:22569 (CONF-8009140—, pp 314-330)
**Turner, J.R.,** *See* Lerner, S., 6:22041
*See* Stout, J.W., 6:22042
**Turner, R.D.,** Superconducting magnetic energy storage applications and benefits for electric utility power systems, 6:22086
**Turner, W.D.,** *See* Mujahid, A., 6:21744
**Twigg, M.E.,** *See* Fraser, H.L., 6:21536
**Tyler, L.D.,** *See* Warpinski, N.R., 6:21603
**Tyler, M.A.,** Selection for a red tide organism: physiological responses to the physical environment, 6:22609
**Tzilkowski, W.M.,** *See* Penman, J.A., 6:22660

## U

**Ulbricht, J.,** Studies on a high-grade polarized lithium-6 target, 6:22506 (ANL-Trans—1195)
**Ulbricht, W.H. Jr.,** Nuclear materials analysis using plasma desorption mass spectometry, 6:21703
**Ullrich, R.L.,** Interactions of radiation and chemical carcinogens, 6:22700
**Ulrickson, M.,** Material selection for TFTR limiters, 6:22921
*See* Dylla, H.F., 6:22929
**Umstadter, D.,** *See* Peebles, W.A., 6:22437
**Unseld, C.T.,** Experiences of residential solar energy users: a review of empirical research, 6:21754
*See* Farhar, B.C., 6:22103
**Unterzuber, R.,** Spent fuel dry storage technology development: thermal evaluation of isolated drywells containing spent fuel (1 kW PWR spent fuel assembly), 6:21648 (DOE/NV/00597—5)
**Upson, C.D.,** *See* Gresho, P.M., 6:22444
**Uri, N.D.,** Analysis of cumulative crude oil discovery and production, 6:22127
**Uribe, F.S.,** *See* Lakner, J.F., 6:22375
**Utell, M.J.,** *See* Morrow, P.E., 6:22716
**Utzinger, D.M.,** Effect of air flow rate in collector-storage walls, 6:21922

## V

**Vahle, M.O.,** SNLA terminal switching network, 6:22976 (SAND—81-0691C)
**Valenty, S.J.,** Monolayer films of surfactant derivatives of methylene blue, 6:21808
**Van Atta, C.M.,** Tandem-mirror program: status and projection, 6:22919 (UCID—18983)

**Van Denventer, E.H.,** Hydrogen permeation characteristics of aluminum-coated and aluminum-modified steels, 6:22952
**van der Leeden, G.A.,** *See* Young, R.T., 6:21759
**van Thiel, M.,** Energy flow in high speed perforation and cutting, 6:22432 (UCRL—85016)
**VanDalen, G.,** *See* Lu, J.J., 6:22819
**VanSant, J.H.,** Cryogenic system for the mirror fusion test facility, 6:22954
**Vartanlan, T.,** *See* Sevilla, M.D., 6:22399
**Vashishta, P.,** *See* Kalia, R.K., 6:22862
**Vasilik, D.G.,** Nuclear accident dosimetry: Los Alamos measurements at the seventeenth nuclear accident dosimetry intercomparison study at the Oak Ridge National Lab., DOSAR Facility, August 1980, 6:22860 (LA—8799-MS)
**Vaughan, D.S.,** Section 316(b) and modeling of ichthyoplankton entrainment, 6:22007 (CONF-810545—2)
**Vavruska, J.S.,** *See* Angelini, P., 6:21660
**Vaz, L.C.,** *See* Fleming, D.G., 6:22380
**Verdon, C.P.,** *See* McCrory, R.L., 6:22908
**Vesely, W.E.,** Some notable probability and statistics problems encountered in risk analysis applications, 6:22070 (CONF-791016—, pp 178-186)
**Vigerstad, T.,** *See* Cohen, A.D., 6:21550
**Viswanathan, V.K.,** *See* Day, R.D., 6:22915
**Vittitoe, C.N.,** Development and testing of FIDELE: a computer code for finite-difference solution to harmonic magnetic-dipole excitation of an azimuthally symmetric horizontally and radially layered earth, 6:22521 (SAND—81-0196)
**Voeks, A.M.,** Preparation of prototype NDA reference materials: a progress report, 6:21702
**Vogt, D.P.,** *See* Bjornstad, D.J., 6:22121
**Vogt, O.,** *See* Sinha, S.K., 6:22318
**Volchok, H.L.,** Development of some natural matrix standards - progress report, 6:22331
Environmental Measurements Laboratory annual report, calendar year 1980, 6:22672 (DOE/EML—392)
**Vollendorf, W.C.,** *See* Warpinski, N.R., 6:21603
**Von Krusenstjern, A.,** *See* Alberth, W., 6:22293
**Vondy, D.R.,** BOLD VENTURE COMPUTATION SYSTEM for nuclear reactor core analysis, Version III, 6:22038 (ORNL—5711)
**Vonk, S.J.,** *See* Perkins, R.A., 6:21511
**Vook, F.L.,** *See* Doyle, B.L., 6:22963
**Voorhees, L.D.,** Highway right-of-way: mowing versus succession as related to duck nesting, 6:22721
**Vories, R.,** *See* Farhar, B.C., 6:22103
*See* Unseld, C.T., 6:21754

## W

**Wada, R.,** Metallic wedge degraders for rapid energy measurement of Bevalac heavy ion beams, 6:22469 (LBL—11726)
**Wade, M.,** *See* Cline, K., 6:22649
**Wade, W.H.,** *See* Nunn, C.C., 6:21579
**Wadt, W.R.,** Geometry and spectral properties of $Ne^{+}_{3}$, $Ar^{+}_{3}$, $Kr^{+}_{3}$, and $Xe^{+}_{3}$, 6:22793
**Wageman, W.E.,** *See* Alei, M. Jr., 6:22389
**Wagner, P.,** *See* Fox, J.P., 6:21617
*See* Peterson, E.J., 6:21616
*See* Thode, E.F., 6:21609
**Wakalopulos, G.,** Pulsed WIP electron gun. Fabrication phase 1 x 40 cm and 1 x 70 cm cooled WIP electron gun. Final report, March 1979-December 1980, 6:22788 (UCRL—15327)
**Walker, D.C.,** *See* Fleming, D.G., 6:22380
**Walker, R.D. Jr.,** Salting-out and multivalent cation precipitation of anionic surfactants, 6:21578
**Walker, R.L.,** Analysis of plutonium and uranium by the resin bead-mass spectrometric method, 6:22358
**Walker, W.C.,** *See* Taylor, R.V., 6:22747
**Walko, R.J.,** $10^{13}$/s 14 MeV neutron generator for cancer therapy, 6:21721
**Wally, K.,** *See* Alvis, R.L., 6:21839
**Walter, K.M.,** *See* Province, S.G., 6:21965
**Walters, A.B.,** Environmental issues and strategies for peat energy development in the US, 6:21565
**Walton, B.T.,** Differential life-stage susceptibility of Acheta domesticus to acridine, 6:22709
**Walton, J.R.,** Quadrupole mass spectrometer for a mobile laboratory to measure isotope ratios, 6:21693 (CONF-810548—3)
**Wampler, F.B.,** *See* Tiee, J.J., 6:22402
**Wang, J.C.F.,** Particle size measurements using an optical variable-frequency-grid technique, 6:22282
**Wang, L.C.,** Highlights of high energy pp, anti pp and $e^{+}e^{-}$ interactions, 6:22817 (BNL—29465)
*See* Prasad, M.K., 6:22839
**Wang, L.L.C.,** Phenomenology of quark mixing and the Kobayashi-Maskawa model, 6:22822 (BNL—29468)
**Wang, R.,** Probable leaching mechanisms for spent fuel, 6:21644 (CONF-8005107—, pp 58-69)
**Wangersky, P.J.,** Fate of sedimented organic carbon in estuaries, 6:22568 (CONF-8009140—, pp 294-313)
**Wantland, J.L.,** Sodium natural convection testing in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility, 6:22072 (CONF-810553—1)
**Wapstra, A.H.,** *See* Martoff, C.J., 6:22849
**Ward, J.W.,** Vapor pressure and thermodynamics of actinide metals, 6:22292
**Warkentien, R.,** *See* Frankel, R., 6:22481
**Warner, B.D.,** *See* Dutton, E.J., 6:21812
**Warpinski, N.R.,** Direct observation of a sand-propped hydraulic fracture, 6:21603 (SAND—81-0225)
**Warren, M.E.,** *See* Boykin, W.H., 6:22024
**Wassinger, C.E.,** Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: an update, 6:21957 (USGS-OFR—80-490)
**Waterbury, G.R.,** Environmental and radiological safety studies. Interaction of $^{238}PuO_2$ heat sources with terrestrial and aquatic environments. Progress report, October 1-December 31, 1980, 6:21691 (LA—8811-PR)
**Waterman, R.E.,** Analysis, simulation and diagnosis of solar energy control system anomalies, 6:21870 (SOLAR/0005—81/80, pp 31-38)
*See* Barvir, E.J., 6:21871
**Wattenberg, A.,** *See* Russell, J.J., 6:22820
**Watts, H.,** *See* Arbital, J., 6:21676
**Watts, R.J.,** *See* Bergkamp, M.A., 6:22384
**Weakliem, H.A.,** *See* Carlson, D.E., 6:21791
**Weaver, H.J.,** *See* McCauley, E.W., 6:22083
**Weaver, J.H.,** Optical properties of metals, 6:22283
**Weaver, R.W.,** Wind loads on photovoltaic arrays, 6:21833
**Weaver, T.A.,** *See* Woosley, S.E., 6:22741
**Weber, M.J.,** Lanthanide and actinide lasers, 6:22377
**Wecksung, G.W.,** *See* Pirkle, F.L., 6:21642
**Weed, H.C.,** *See* Piwinskii, A.J., 6:22733
**Weeks, C.,** *See* Huberman, E., 6:22616
**Weigel, H.S.,** Demand for world coal through 1995, 6:21564
**Weinstein, B.W.,** Interferometric measurements of multilayer and double-shell inertial fusion targets, 6:22935
*See* Hatcher, C.W., 6:22934
**Weinstein, M.,** *See* Lee, W.H., 6:21601
**Weinstein, R.A.,** *See* Cramer, M.A., 6:21868
**Weinstock, E.V.,** *See* de Montmollin, J.M., 6:21713
**Weir, J.T.,** *See* Singleton, R.M., 6:22946
*See* Weinstein, B.W., 6:22935
**Weis, T.P.,** Linear system analysis program: programmer's manual, 6:22979 (UCID—30183)
**Weiss, A.W.,** Correlation corrections to energy levels of Fe XXI, 6:22760 (ANL—80-126, pp 166-170)
Review of atomic structure calculations, 6:22767 (ANL—80-126, pp 272-285)
**Weiss, J.R.,** *See* Freeman, B.P., 6:22359
*See* Holland, M.K., 6:22353
**Weissenberger, S.,** Energy and technology review, 6:22920 (UCRL—52000-81-6)
**Weissman-Wenocur, D.L.,** *See* Shek, M.L., 6:22288
**Weitl, F.L.,** *See* Raymond, K.N., 6:22698
**Welge, K.H.,** *See* Lyman, J.L., 6:22339
**Wells, M.B.,** *See* Rubin, R.M., 6:21639
**Wendell, L.L.,** Federal Wind Energy Program for wind resource assessment and siting: an overview, 6:21981
**Wendt, R.L.,** Energy conservation through site planning: a systems approach, 6:22557 (CONF-810531—1)
**Weres, O.,** *See* Pruess, K., 6:21960
**Werner, R.W.,** Fusion-synfuel tie producing hydrogen with the tandem mirror, 6:21723
Optimizing the heat pipe for operation in a magnetic field when liquid-metal working fluids are used, 6:22428 (UCID—19049)
**Wernette, D.R.,** *See* Santini, D.J., 6:22100
**West, C.E.,** Feasibility study for anaerobic digestion of agricultural crop residues. 1980 update. Final report, 6:21730 (SERI/TR—98175-1)
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, July 1-September 30, 1979, 6:21558 (DOE/CS/40037—T1)
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, October 1-December 31, 1979, 6:21559 (DOE/CS/40037—T2)

**Westbrook, C.K.,** Experimental and theoretical study of flame inhibition by bromine-containing compounds, 6:21731 (UCRL—85409)
**Westbrook, R.D.,** *See* Lowndes, D.H., 6:21760
**Wetzel, J.S.,** *See* Ramsdell, J.V., 6:21978
**Wheeler, M.L.,** Low-level-waste-disposal methodologies, 6:21672 (LA-UR—81-1385)
**Whiddon, W.I.,** *See* Gordon, H.T., 6:21896
**Whitaker, T.J.,** *See* Bushaw, B.A., 6:22805
**White, A.,** *See* Frankel, R., 6:22481
**White, C.W.,** *See* Jellison, G.E., 6:21758
*See* Zehner, D.M., 6:22324
**White, D.H.,** Evaluation of geothermal energy in Arizona. Arizona geothermal planning/commercialization team. Quarterly topical progress report, July 1-September 30, 1980, 6:21955 (DOE/RA/50076—T3)
**White, G.M.,** *See* Parker, B.F., 6:21951
**Whitfield, R.,** *See* Wolsko, T., 6:21811
**Whitley, J.B.,** *See* Mullendore, A.W., 6:22923, 6:22957
**Whitman, R.,** *See* Wilkinson, C., 6:22821
**Whorf, T.P.,** *See* Bacostow, R.B., 6:22550
**Wilburn, N.P.,** Application of software engineering to development of reactor-safety codes, 6:22077 (HEDL-SA—2244-FP)
Application of software to development of reactor-safety codes, 6:22078 (HEDL-SA—2244-S)
**Wilcke, W.F.,** *See* Bern, C.J., 6:21879
**Wilems, R.,** *See* Arbital, J., 6:21676
**Wilems, R.E.,** Retrievability: technical considerations, 6:21678 (ONWI—203)
**Wilkinson, C.,** Polarization of $S^+$ hyperons produced by 400-GeV protons, 6:22821
*See* Cox, P.T., 6:22818
**Wilkinson, J.,** *See* Sullo, P., 6:22105
**Willard, K.E.,** Alterations of two-dimensional electrophoretic maps in human peripheral blood lymphocytes induced by concanavalin A, 6:22711
*See* Hickman, B.J., 6:22620
**Wille, G.W.,** Hydrogen in titanium alloys, 6:22270 (DOE/ET/52039—2)
**Willen, E.H.,** Effective trigger at the Brookhaven Multi-Particle Spectrometer (MPS), 6:22513
**Willenborg, D.L.,** *See* Weinstein, B.W., 6:22935
**Willey, C.,** Determination of sulfur heterocycles in coal liquids and shale oils, 6:21537
**Williams, J.M.,** *See* Schmidt, G.F., 6:22371
**Williams, L.R.,** *See* Ragan, G.L., 6:21646
**Williams, R.A.,** *See* Butler, H.S., 6:22486
**Williams, R.C.,** Gm allotypes in mother-father-cord trios: a selective transfer of autologous, fetal IgG to the mother, 6:22667
IgG levels in mother-father-cord trios: evidence for a large reduction of maternal IgG at birth, 6:22668
**Wilson, K.L.,** Deuterium trapping measurements in aluminum and plasma-sprayed aluminum coatings, 6:22956
**Wilson, P.B.,** Computer simulation of longitudinal single-bunch effects in electron-positron storage rings, 6:22476 (SLAC-PUB—2688)
Prospects for very-high-gradient linac-colliders, 6:22498 (SLAC-PUB—2689)
**Wilson, R.,** *See* Salamandra, J., 6:21586
**Wilson, S.L.,** *See* Butler, H.S., 6:22486
**Winblad, A.E.,** Analysis of protection requirements for away-from-reactor spent fuel storage facilities, 6:21650 (SAND—81-0605C)
**Windawi, H.,** Chemisorption—corrosion transition: The role of surface impurities as markers for evaluating the transition, 6:22290
**Wing, N.D.,** *See* Doyle, B.L., 6:22787
**Winkler, M.A.,** *See* Brixner, B., 6:22519
**Winn, C.B.,** Use of the atop system in the control of an off-peak storage device, 6:22221
*See* Marshall, L.S., 6:21908
**Winn, W.G.,** Gamma-ray monitor for plutonium uniformity in fuel tubes, 6:22054 (DP-MS—80-120)
**Winske, D.,** Current-driven microinstabilities in a neutral sheet, 6:22891
*See* Sgro, A.G., 6:22898
**Wise, D.L.,** *See* Ruoff, C.F., 6:21520
**Wise, K.D.,** Solid-state processes to produce hemispherical components for inertial fusion targets, 6:22933
**Wisniewski, W.J.,** *See* Russell, J.J., 6:22820
**Wiss, J.,** *See* Russell, J.J., 6:22820
**Witherspoon, P.A.,** New approaches to problems of fluid flow in fractured-rock masses, 6:22730 (LBL—12511)
**Witt, J.,** *See* Swann, T., 6:22913
**Witt, L.A.,** *See* Letts, S.A., 6:21719
**Wolcott, M.,** Mobile source emission inventory, 6:22544 (EPA-AA-TEB—81-11)
**Wolf, M.,** Analysis and evaluation in the production process and equipment area of the low-cost solar-array project. Quarterly report, July-October, 1980, 6:21767 (DOE/JPL/954796—81/12)
**Wolff, R.K.,** *See* Schnizlein, C.T., 6:22708
**Wollast, R.,** Fate of terrestrial organic carbon in the coastal area, 6:22570 (CONF-8009140—, pp 331-359)
**Wolsko, T.,** Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**Wong, C.S.,** *See* Bacostow, R.B., 6:22550
**Wong, E.,** *See* Kowalik, R.M., 6:21998
**Wong, E.W.,** *See* Irwin, C.F., 6:21514
**Woo, C.K.,** *See* Rains, D., 6:21853
**Wood, D.O.,** *See* Hollander, J.M., 6:22122
**Wood, E.S.,** *See* Brooks, S.O., 6:22248
**Wood, R.F.,** *See* Lowndes, D.H., 6:21760, 6:22314
**Woodfin, G.L.,** *See* Day, R.D., 6:22915
**Woolsey, N.F.,** Quantitation of the reductive cleavage of aryl ethers of SRC and coals. Semi Annual report, September 1980-March 1981, 6:21507 (DOE/PC/30227—T1)
*See* Baltisberger, R.J., 6:21502
**Woosley, S.E.,** Anomalous isotoptic composition of cosmic rays, 6:22741
**Worden, E.F.,** Multistep laser photoionization of the lanthanides and actinides, 6:22811
**Worgul, B.,** *See* Harding, C.V., 6:22647
**Worwetz, H.A.,** *See* Hseuh, H.C., 6:22452
**Woteki, T.H.,** Estimating residential energy consumption from the national interim energy consumption survey: a progress report, 6:22163 (CONF-791016—, pp 91-93)
**Wozniak, G.J.,** *See* Sobotka, L.G., 6:22851
**Wozynski, C.D.,** *See* Brooks, A.L., 6:22430
**Wright, I.G.,** Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report, 6:21497 (DOE/ET/13537—T3)
**Wright, J.B.,** *See* Unterzuber, R., 6:21648
**Wright, J.K.,** Office of the Inspector General. Annual report, 6:22967 (DOE/IG—0008/1)
**Wright, R.B.,** *See* Pellin, M.J., 6:22803
**Wright, W.,** *See* Sullivan, P., 6:21926
**Wright, W.A.,** Graphic passive design tools for annual performance in the Northeast, 6:21928
**Wronski, C.R.,** *See* Moustakas, T.D., 6:21787
**Wu, C.H.,** Co adsorption on Al-Zr at room temperature, 6:22926
**Wu, C.S.,** *See* Krishnaswamy, S.V., 6:22325
**Wu, J.R.,** Mechanisms for (p,p′) reactions in the continuum, 6:22846
**Wu, Z.,** *See* Taylor, R.V., 6:22747
**Wyart, J.,** 3d—4p transitions in the zinclike and copperlike ions Y X, XI; Zr XI, XII; Nb XII, XIII; and Mo XIII, XIV, 6:22281
**Wysocki, M.D.,** Williamson house as simulated by the DEROB system: a field validation, 6:21919
**Wyzga, R.E.,** *See* Ricci, P.F., 6:22703

## X

**Xuan, P.T.,** *See* Jones, G. II, 6:21809

## Y

**Yagnik, S.,** *See* Machiels, A.J., 6:22724
**Yang, H.T.,** *See* Zehr, S.W., 6:21801
**Yang, J.J.J.,** *See* Zehr, S.W., 6:21801
**Yang, Y.,** Laser-excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 6:22345
**Yarbrough, D.W.,** Operating temperatures of recessed fluorescent fixtures with thermal insulation, 6:22210 (ORNL/Sub—7715/4)
**Yarosh, M.M.,** Consumer experience: implications for government solar policy, 6:21756
**Yates, G.J.,** *See* King, N.S.P., 6:22520
**Yayanos, A.A.,** *See* Gomez, L.S., 6:21685
**Yazaki, K.,** *See* Lenz, F., 6:22855
**Yesavage, V.F.,** *See* Kidnay, A.J., 6:21496
**Yeung, E.S.,** *See* Steenhoek, L.E., 6:22401
**Ying, D.H.S.,** Gas/slurry flow in coal-liquefaction processes (fluid dynamics in 3-phase flow columns). Quarterly technical progress report, 1 July 1980-30 September 1980, 6:21498 (DOE/ET/14801—12)
**Yngve, P.W.,** Residual energy applications program systems analysis report, 6:22241 (DOE/ET/12866—3)

**Yoo, H.,** Performance improvement of silicon sheet solar cells by process optimization, 6:21803
**Yoo, H.I.,** Silicon solar cell process development, fabrication, and analysis. Eighth quarterly report, 1 October 1980-31 December 1980, 6:21768 (DOE/JPL/955089—80/10)
**Yook, H.,** *See* Arbital, J., 6:21676
**Yoshihara, C.M.,** *See* Mohrenweiser, H., 6:22640
**Young, D.A.,** Theoretical calculation of thermodynamic properties and melting curves for hydrogen and deuterium, 6:22316
**Young, L.Y.,** *See* Colberg, P.J., 6:21729
**Young, R.T.,** Effect of lithium diffusion into polycrystalline Si solar cells, 6:21759 (CONF-810526—27)
*See* Jellison, G.E., 6:21758
**Yu, C.M.,** *See* Illige, J.D., 6:22939
**Yuen, G.,** *See* Fugitt, J., 6:22488

## Z

**Zaccaria, F.,** *See* Mukunda, N., 6:22868
**Zagarino, P.,** *See* Lyons, P.B., 6:22879
**Zajc, W.A.,** *See* Martoff, C.J., 6:22849
**Zamecnik, P.C.,** *See* Rapaport, E., 6:22614
**Zamyshlyaev, V.G.,** *See* Gel'perin, N.I., 6:22360
**Zavelovich, J.,** VUV fluorescence following photodissociation of $N_2O$ at 193 nm, 6:22795
**Zehner, D.M.,** Atomic structure of laser annealed Si(111)—(1 x 1), 6:22324
**Zehr, S.W.,** Non-lattice-matched monolithic multicolor solar cell, 6:21801
**Zeman,** *See* Butler, H.S., 6:22486
**Zhou, S.Y.,** Redistribution of ruthenium in $UO_2$ in a temperature gradient, 6:22301 (LBL—12548, pp 47-52)
**Zimmerman, G.P.,** *See* Holcomb, R.S., 6:21992
**Zinn, C.D.,** *See* Lesso, W.G., 6:21966
**Zitko, V.,** Role of biodegradability in the environmental evaluation of polychlorinated biphenyls and chemicals in general, 6:22600
**Zivi, S.M.,** *See* Hubbard, H.W., 6:22082
**Zoback, M.L.,** *See* Sass, J.H., 6:21964
**Zook, A.C.,** Application of a direct method for the determination of trace uranium in safeguards samples by pulsed laser fluorometry, 6:22357
**Zorn, G.A.,** Adenovirus type 2 expresses fiber in monkey-human hybrids and reconstructed cells, 6:22653
**Zussman, S.K.,** *See* Saguinsin, J.L.S., 6:22723

# SUBJECT INDEX

The subject index is based on the use of subject descriptors selected from a controlled thesaurus of terms. Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

**SUBJECT DESCRIPTOR**
**Qualifier**
Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

## A


**ABANDONED SITES**
**Environmental Impacts**
Retort abandonment: issues and research needs, 6:21617 (LBL—11197)

**ABDOMEN**
**Ultrasonography**
Experiences using B scanning techniques in the dog, 6:22645 (FDA—81-8042)

**AC SYSTEMS**
*See also EHV AC SYSTEMS*
*UHV AC SYSTEMS*
**Control Systems**
Robust control of multiterminal dc/ac systems, 6:22022

**ACCELERATORS**
*See also BEVALAC*
*BEVATRON*
*COCKCROFT-WALTON ACCELERATORS*
*FERMILAB ACCELERATOR*
*HEAVY ION ACCELERATORS*
*LAMPF LINAC*
*LINEAR ACCELERATORS*
*RAILGUN ACCELERATORS*
*STANFORD 20-GEV LINAC*
*TANDEM ELECTROSTATIC ACCELERATORS*
*UCLRL CYCLOTRONS*
*VAN DE GRAAFF ACCELERATORS*
**Ion Beams**
Ion beam characteristics of a gas-filled accelerator tube, 6:22809
**Vacuum Systems**
Steam ejector-condenser: stage I of a differential vacuum pumping station, 6:22454

**ACETYLENES**
*See ALKYNES*

**ACID ELECTROLYTE FUEL CELLS**
**Fuel Systems**
Critical evaluation of fuel-processing technologies for fuel cells. Quarterly report, December 1, 1980-February 28, 1981, 6:22160 (DOE/ET/17103—2)
**Materials Testing**
Technology development for phosphoric acid fuel cell powerplant (Phase II): 7th quarterly report, 6:22162 (DOE/NASA/0067—79-6)
**Performance Testing**
Technology development for phosphoric acid fuel cell powerplant (Phase II): 7th quarterly report, 6:22162 (DOE/NASA/0067—79-6)

**ACIDITY**
*See PH VALUE*

**ACOUSTIC MONITORING**
**Feasibility Studies**
Review of remote-sensor potential for wind-energy studies, 6:21983 (DOE/ET/23151—80/1)

**ACRIDINES**
**Toxicity**
Differential life-stage susceptibility of Acheta domesticus to acridine, 6:22709

**ACRYLAMIDE**
**Copolymerization**
Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310

**ACRYLIC POLYMERS**
*See POLYACRYLATES*

**ACRYLONITRILE**
**Comparative Evaluations**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600

**ACTINIDE COMPOUNDS**
**Energy Levels**
Optical properties of actinide and lanthanide ions, 6:22378
**Optical Properties**
Optical properties of actinide and lanthanide ions, 6:22378
**Stimulated Emission**
Lanthanide and actinide lasers, 6:22377

**ACTINIDES**
**Chelating Agents**
Specific sequestering agents for the actinides, 6:22698
**Crystal Doping**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Meetings**
Lanthanide and actinide chemistry and spectroscopy, 6:22376
**Photoionization**
Multistep laser photoionization of the lanthanides and actinides, 6:22811
**Solidification**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Thermodynamic Properties**
Vapor pressure and thermodynamics of actinide metals, 6:22292

**ADENINES**
**Radiation Chemistry**
ESR study of DNA base cation radicals produced by attack of oxidizing radicals, 6:22405

**ADENOVIRUS**
**Messenger-RNA**
Adenovirus type 2 expresses fiber in monkey-human hybrids and reconstructed cells, 6:22653

**ADIABATIC REFORMER PROCESSES**
*See AUTOTHERMAL REFORMER PROCESSES*

**ADIPIC ACID**
**Electron Spectra**
Photoelectron spectroscopy of carbonyls: saturated normal dicarboxylic acids, 6:22382
**ADRENAL GLANDS**
**Pathological Changes**
Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age, 6:22677 (FDA—81-8042)
**ADSORPTION**
**Auger Electron Spectroscopy**
Co adsorption on Al-Zr at room temperature, 6:22926
**Pressure Measurement**
Co adsorption on Al-Zr at room temperature, 6:22926
**ADULTS**
**Lymphocytes**
Distribution of T and B lymphocytes in blood and lymphoid tissues of fetal and adult sheep, 6:22634
**ADVECTION**
**Calculation Methods**
Examination of some simple numerical schemes for calculating scalar advection, 6:22531
**AEROSOLS**
**Production**
Bio/organic analysis section, 6:22334 (ORNL—5738)
**Thermal Analysis**
Role of black carbon in the organic chemistry of atmospheric aerosols, 6:22532 (LBL—12540)
**AFLATOXIN**
**Toxicity**
Chemical carcinogenesis. Chapter 12, 6:22717
**AFR STORAGE**
*See AWAY-FROM-REACTOR STORAGE*
**AFRICA**
**Geothermal Resources**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)
**AGRICULTURAL RESIDUES**
*See AGRICULTURAL WASTES*
**AGRICULTURAL WASTES**
**Acid Hydrolysis**
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980 (Autohydrolysis), 6:21729 (SERI/TR—98174-1)
**Anaerobic Digestion**
Feasibility study for anaerobic digestion of agricultural crop residues. 1980 update. Final report, 6:21730 (SERI/TR—98175-1)
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980 (Autohydrolysis), 6:21729 (SERI/TR—98174-1)
**AGRICULTURE**
*See also DAIRY INDUSTRY*
*FARMS*
Agriculture, greenhouse, wetland and other beneficial uses of geothermal fluids and heat, 6:21976 (CONF-810471—1)
**Energy Consumption**
Michigan farm energy audit study: phase I, 6:22246
**Meetings**
Agricultural energy. Vol. 1. Solar energy livestock production, 6:21878
**AIR**
*See also EARTH ATMOSPHERE*
**Corrosive Effects**
Chemical durability improvement of glass shells, 6:22947
**Radiation Monitoring**
Real-time tritium monitor with an MPC proportional response to airborne mixtures of TH and THO, 6:22515
**AIR CONDITIONERS**
*See also SOLAR AIR CONDITIONERS*
**Performance**
Cooling-and-heating-load improvements in seasonal-performance modeling of room and central air conditioners and heat pumps, 6:22213 (SAI—444-80-299-LJ)
**AIR CONDITIONING**
*See also SOLAR AIR CONDITIONING*
**Energy Demand**
Preliminary market analysis for customer side of the meter thermal-energy storage, 6:22193 (DOE/ET/26716—T1)
**AIR HEATERS**
*See also SOLAR AIR HEATERS*
**Design**
MHD air heater technology development. Annual technical progress report, January 1, 1980-December 31, 1980, 6:22149 (DOE/ET/15602—T4)
**Materials Testing**
MHD air heater technology development. Annual technical progress report, January 1, 1980-December 31, 1980, 6:22149 (DOE/ET/15602—T4)
**AIR INFILTRATION**
**Measuring Methods**
Building infiltration, 6:22176 (CONF-8003114—)
**AIR POLLUTION**
**Chemical Composition**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Daily Variations**
n-dimensional pattern recognition in environmental systems, 6:22540 (CONF-801045—)
**Environmental Transport**
Computational codes for calculating dispersion from accidental releases of pollutants, 6:22543 (DP-MS—80-85)
Modeling pollutant dispersion within a tornadic thunderstorm, 6:22542 (DP-MS—80-84)
**Health Hazards**
Statistical review of cross-sectional studies of ambient air pollution and mortality, 6:22703 (CONF-801045—)
**Scrubbing**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**AIR POLLUTION ABATEMENT**
**Cost Benefit Analysis**
Regional and national $SO_2$ control costs, 6:22464 (ANL/EES-TM—130)
**AIR POLLUTION CONTROL**
**Government Policies**
In pursuit of clean air: a data book of problems and strategies at the state level. Supplement, 6:22535 (ANL/EES-TM—129)
**Technology Assessment**
Air quality analysis of Phase I of the proposed oil backout legislation (Lead abstract), 6:21540 (ANL/EES-TM—130)
**AIR QUALITY**
**Mathematical Models**
Estimated ambient $SO_2$ and $SO_4$ impacts, 6:22536 (ANL/EES-TM—130)
**Monitoring**
Estimated ambient $SO_2$ and $SO_4$ impacts, 6:22536 (ANL/EES-TM—130)
**Standards**
Proceedings of the 1980 DOE statistical symposium (Lead Abstract), 6:22538 (CONF-801045—)
Simple models and the comparison of monitoring rules related to National Ambient Air Quality Standards, 6:22539 (CONF-801045—)
**Statistical Models**
Proceedings of the 1980 DOE statistical symposium (Lead Abstract), 6:22538 (CONF-801045—)
Simple models and the comparison of monitoring rules related to National Ambient Air Quality Standards, 6:22539 (CONF-801045—)
**AIRFOILS**
**Protective Coatings**
Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils, 6:21999 (DOE/ET/12292—T1)
**ALAP**
*See RADIATION PROTECTION*

**ALARM DOSEMETERS**
*See RADIATION MONITORS*
**ALASKA**
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**ALCOHOL FUELS**
**Budgets**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Financial Data**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**ALDEHYDES**
*See also ARABINOSE*
*GLUCOSE*
**Biological Effects**
Modification of erythrocyte physicochemical properties by millimolar concentrations of glutaraldehyde, 6:22718
**Photolysis**
ESR study of electron reactions with carboxylic acids, ketones, and aldehydes in aqueous glasses, 6:22399
**Reduction**
Mild and convenient conversion of ketones to the corresponding methylene derivatives via reduction of tosylhydrazones by bis(benzoyloxy)borane, 6:22386
**Stereochemistry**
Restricted rotation in hydroxyphenyl ketones and formaldehydes, 6:22385
**ALGAE**
*See also PORPHYRA*
**Physiology**
Selection for a red tide organism: physiological responses to the physical environment, 6:22609
**Population Dynamics**
Selection for a red tide organism: physiological responses to the physical environment, 6:22609
**ALKALI METALS**
*See also CESIUM*
*LITHIUM*
*POTASSIUM*
*SODIUM*
**Membrane Transport**
Separation of alkali, alkaline earth and rare earth cations by liquid membranes containing macrocyclic carriers. Third progress report, September 1, 1980-April 1, 1981, 6:22326 (DOE/ER/05016—3)
**ALKALINE EARTH METALS**
*See also BARIUM*
*BERYLLIUM*
*CALCIUM*
*MAGNESIUM*
*STRONTIUM*
**Membrane Transport**
Separation of alkali, alkaline earth and rare earth cations by liquid membranes containing macrocyclic carriers. Third progress report, September 1, 1980-April 1, 1981, 6:22326 (DOE/ER/05016—3)
**ALKANES**
*See also BUTANE*
*DECANE*
*ETHANE*
*HEXADECANE*
*METHANE*
*PARAFFIN*
*PENTANE*
*PROPANE*
*SQUALANE*
**Synthesis**
Alkanes obtained by thermal conversion of Green River oil-shale kerogen using CO and H/sub 2/O at elevated pressure, 6:21614
**ALKENOIC ACIDS**
*See CARBOXYLIC ACIDS*
**ALKYLATING AGENTS**
**Toxicity**
Cytotoxicity and mutagenicity of alkylating agents in cultured mammalian cells (CHO/HGPRT system): mutagen treatment in the presence or absence of serum, 6:22714
**ALKYNES**
**Absorption Spectra**
Vibrational relaxation in jet-cooled phenylalkynes, 6:22797
**Fluorescence**
Vibrational relaxation in jet-cooled phenylalkynes, 6:22797
**Infrared Spectra**
Vibrational relaxation in jet-cooled phenylalkynes, 6:22797
**ALLIGATORS**
**Sensitivity**
Parasite fauna of the American alligator (Alligator mississippiensis) in South Carolina, 6:22659
**ALLOY-HD-8077**
*See NICKEL BASE ALLOYS*
**ALLOY-MA-754**
*See NICKEL BASE ALLOYS*
**ALLOYS**
**Corrosion Resistance**
Evaluation of alloys for fuel cell heat exchangers. Final report (Texaco entrained gasifier), 6:21511 (EPRI-EM—1815)
**Sulfidation**
Evaluation of alloys for fuel cell heat exchangers. Final report (Texaco entrained gasifier), 6:21511 (EPRI-EM—1815)
**ALLOY-WAZ-16**
*See NICKEL BASE ALLOYS*
**ALPHA PARTICLES**
**Alpha Detection**
New advances in alpha spectrometry by liquid scintillation methods, 6:22516
**ALPHA REACTIONS**
**Capture**
Evidence for giant E2 transitions in high-energy a-particle capture, 6:22848
**ALPHA SPECTROSCOPY**
**Liquid Scintillation Detectors**
New advances in alpha spectrometry by liquid scintillation methods, 6:22516
**ALTERNATE FUELS**
*See SYNTHETIC FUELS*
**ALUMINA**
*See ALUMINIUM OXIDES*
**ALUMINIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Corrosion**
Atmospheric corrosion of batten and enclosure materials for flat-plate solar collectors, 6:21936 (ANL/EES-TM—135)
**Frenkel Defects**
Defect clustering in copper, silver and aluminium during heavy-ion irradiations at low temperatures (AR or Kr ions, or 150 kev protons), 6:22272
**Melting**
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, July 1-September 30, 1979, 6:21558 (DOE/CS/40037—T1)
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, October 1-December 31, 1979, 6:21559 (DOE/CS/40037—T2)
**Permeability**
Hydrogen permeation characteristics of aluminum-coated and aluminum-modified steels, 6:22952
**Production**
Production of aluminum-silicon alloy and ferrosilicon and commercial purity aluminum by the direct reduction process. First interim technical report, Phase D, January 1-March 31, 1981, 6:22266 (CONS—5089-15)
**ALUMINIUM ALLOYS**
*See also ALUMINIUM BASE ALLOYS*
**Adsorption**
Co adsorption on Al-Zr at room temperature, 6:22926
**Cleaning**
Test results of heat-exchanger cleaning in support of ocean thermal energy conversion, 6:21841 (DOE/CH/00135—3)
**Heat Transfer**
Test results of heat-exchanger cleaning in support of ocean thermal energy conversion, 6:21841 (DOE/CH/00135—3)

**ALUMINIUM BASE ALLOYS**
**Physical Radiation Effects**
Tunneling of mixed dumbbells in Al-Zn, 6:22268 (DOE/ER/01198—1352)
**Production**
Production of aluminum-silicon alloy and ferrosilicon and commercial purity aluminum by the direct reduction process. First interim technical report, Phase D, January 1-March 31, 1981, 6:22266 (CONS—5089-15)
**ALUMINIUM CHLORIDES**
**Purification**
Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)
**Radiosensitivity Effects**
Irradiation of microorganism such as bacteria and viruses in the presence of chemical enhancing agent, 6:22696
**Recovery**
Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)
**ALUMINIUM COMPOUNDS**
**Bending**
High temperature applications of structural ceramics. Quarterly progress report, January-March 1981, 6:22296 (DOE/OR/20679—T4)
**ALUMINIUM IODIDES**
**Corrosive Effects**
Stress corrosion cracking of zircaloy by metal iodides and cadmium, 6:22274 (LBL—12548)
**ALUMINIUM OXIDES**
**Failures**
Failure modes of Na-beta alumina (Solid electrolytes in sodium-sulfur batteries), 6:22091 (LBL—12445)
**Reduction**
Molecular beam studies of atomic hydrogen reduction of refractory oxides, 6:22275 (LBL—12548)
**Sorptive Properties**
Adsorption from selected microemulsions onto alumina, 6:21579
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**AMBIENT TEMPERATURE**
**Correlations**
Atmospheric carbon dioxide, the southern oscillation, and the weak 1975 El Nino, 6:22550
**AMERICIUM 241**
**Electron Spin Resonance**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)
**AMERICIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**AMIDES**
*See also ACRYLAMIDE*
**Absorption Spectroscopy**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Adsorption**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Chromatography**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**AMINES**
*See also ADENINES*
*CYTOSINE*
*GUANINE*
*HYDROXYLAMINE*
*METHYLENE BLUE*
*QUATERNARY COMPOUNDS*
**Qualitative Chemical Analysis**
Critical examination of the salicylaldehyde method for the determination of primary amines in the presence of secondary amines, 6:22628
**Toxicity**
Chemical carcinogenesis. Chapter 12, 6:22717
**AMINOGLYCIDES**
*See AMINES*
*SACCHARIDES*
**AMINOHYPOXANTHINE**
*See GUANINE*
**6-AMINOPURINE**
*See ADENINES*
**AMMONIA**
**Chemical Reaction Kinetics**
Characterization of the selective reduction of NO by $NH_3$, 6:22465 (LBL—12215)
**Chemical Reactions**
Critical conditions for the growth of SiC, $Si_3N_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981, 6:22295 (DOE/ER/10438—T1)
**Luminescence**
Temperature dependence of the luminescence lifetimes of halopentaammine- and hexaamminerhodium(III) compounds in the solid state, 6:22384
**AMMONIUM CHLORIDES**
**Biodegradation**
Role of biodegradation kinetics in predicting environmental fate, 6:22589
**AMNION CELLS**
*See EMBRYONIC CELLS*
**ANAEROBIC DIGESTION**
**Economic Analysis**
Feasibility study for anaerobic digestion of agricultural crop residues. 1980 update. Final report, 6:21730 (SERI/TR—98175-1)
**Feasibility Studies**
Feasibility study for anaerobic digestion of agricultural crop residues. 1980 update. Final report, 6:21730 (SERI/TR—98175-1)
**Temperature Dependence**
Full scale field demonstration of unheated anaerobic contact stabilization. Project status report, October 1980-February 1981, 6:21726 (DOE/CS/24310—3)
**Time Dependence**
Full scale field demonstration of unheated anaerobic contact stabilization. Project status report, October 1980-February 1981, 6:21726 (DOE/CS/24310—3)
**ANEMOMETERS**
**Performance Testing**
Wind measurement systems and wind tunnel evaluation of selected instruments, 6:21978 (PNL—3435)
**ANHYDRIDES**
**Absorption Spectroscopy**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**Hydrolysis**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**ANHYDRITE**
**Compression**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Poisson Ratio**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Shear Properties**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Stresses**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Yield Strength**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)

**Young Modulus**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)

**ANIMAL CELLS**
*See also EMBRYONIC CELLS*
*RESPIRATORY TRACT CELLS*
*TUMOR CELLS*

**Cell Differentiation**
Alterations in polyamine levels induced by phorbol diesters and other agents that promote differentiation in human promyelocytic leukemia cells, 6:22616

**Growth**
Alterations in polyamine levels induced by phorbol diesters and other agents that promote differentiation in human promyelocytic leukemia cells, 6:22616

**Hybridization**
Adenovirus type 2 expresses fiber in monkey-human hybrids and reconstructed cells, 6:22653
Dependence of herpes simplex virus type 1-induced cell fusion on cell type, 6:22650

**Oncogenic Transformations**
Scanning electron microscopy of differentiated liver cells transformed in vitro by chemical carcinogens, 6:22635

**ANIMAL GROWTH**

**Biological Models**
Implications of a partial-differential-equation cohort model, 6:22610

**Forecasting**
Prediction of skeletal mass in growing and adult beagles, 6:22656

**ANIMAL SHELTERS**

**Solar Space Heating**
Predicted performance of the KSU solar collector-storage system, 6:21881
Solar heating of poultry laying houses in the northern states, 6:21884
Solar poultry brooding research at the Southeast Poultry Research Laboratory: a progress report, 6:21883
Solar space heating a growing-finishing swine building without added thermal storage, 6:21882

**Ventilation**
Predicted performance of the KSU solar collector-storage system, 6:21881

**ANIONS**

**Membrane Transport**
Anionic detergents as divalent cation ionophores across black lipid membranes, 6:22627

**ANNUAL ENERGY STORAGE**

**Cold Storage**
Longterm storage of coolness (In cisterns), 6:21953

**ANTARES FACILITY**

**Alignment**
Antares alignment gimbal positioner, 6:22915 (LA-UR—81-1394)
Opto-mechanical devices for the Antares automatic beam alignment system, 6:22913 (LA-UR—81-1229)

**ANTIBIOTICS**

**Biological Accumulation**
Host-pathogen interactions. XV. Fungal glucans which elicit phytoalexin accumulation in soybean also elicit the accumulation of phytoalexins in other plants, 6:22649

**Thin-Layer Chromatography**
Host-pathogen interactions. XV. Fungal glucans which elicit phytoalexin accumulation in soybean also elicit the accumulation of phytoalexins in other plants, 6:22649

**ANTRIM SHALES**
*See BLACK SHALES*

**ANTS**
*See INSECTS*

**APARTMENT BUILDINGS**

**Energy Conservation**
Bottom line: comments on incremental costs in the Massachusetts multi-family passive solar housing program, 6:21903

**Energy Consumption**
Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings, 6:22222 (DOE/TIC—11459)

**Energy Efficiency**
Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings, 6:22222 (DOE/TIC—11459)

**Energy Efficiency Standards**
Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings, 6:22222 (DOE/TIC—11459)

**Solar Space Heating**
Bottom line: comments on incremental costs in the Massachusetts multi-family passive solar housing program, 6:21903
Massachusetts multi-family passive solar housing program, 6:21913
Solar project description for Matt Cannon multi-unit apartment, Gainesville, Florida, 6:21935 (SOLAR/1044—80/50)

**Solar Water Heaters**
Solar project description for Matt Cannon multi-unit apartment, Gainesville, Florida, 6:21935 (SOLAR/1044—80/50)

**Solar Water Heating**
Performance of solar energy hot water systems, 6:21868 (SOLAR/0005—81/80)

**APPALACHIA**

**Natural Gas Deposits**
Quantitative analysis of the economically recoverable resource, 6:21597 (DOE/MC/08216—157)

**Resource Assessment**
Quantitative analysis of the economically recoverable resource, 6:21597 (DOE/MC/08216—157)

**APPARATUS**
*See EQUIPMENT*

**APPLIANCES**
*See also AIR CONDITIONERS*
*DEHUMIDIFIERS*
*ELECTRIC APPLIANCES*
*FREEZERS*
*REFRIGERATORS*
*STOVES*
*WATER HEATERS*

**Information**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))

**APPROPRIATE TECHNOLOGY**

**Grants**
Regional and community impacts of the Department of Energy. Energy technology pilot program in the western Pacific, 6:21932

**AQUACULTURE**

**Waste Heat Utilization**
Overview of waste-heat-utilization techniques, 6:22110

**AQUATIC ECOSYSTEMS**

**Environmental Exposure Pathway**
Critical pathways of polycyclic aromatic hydrocarbons in aquatic environments, 6:22584

**Food Chains**
Microbial roles in aquatic food webs, 6:22654

**Hydrology**
Deposition of riverborne organic carbon in floodplain wetlands and deltas, 6:22564 (CONF-8009140—)

**Mathematical Models**
Theoretical implications of spatial heterogeneity in stream ecosystems, 6:22611

**Population Dynamics**
Heterotrophic-photoautotrophic index: a qualitative parameter of microbial interactions applied to a Gulf Stream intrusion, 6:22655

**AQUIFERS**

**Sensible Heat Storage**
Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)

**ARABINOSE**
**Radiosensitivity Effects**
Effect of cytosine arabinoside on the frequency of x-ray-induced chromosome aberrations in normal human leukocytes, 6:22699
**ARGON**
Moessbauer characterization of reactively sputtered iron nitride films, 6:22303
**Atom-Molecule Collisions**
Monte Carlo trajectory calculations of the energy of activation for collision-induced dissociation of $H_2$ by Ar as a function of rotational energy, 6:22794
**Ion Collisions**
Argon ion impact desorption cross sections of chlorine and carbon from nickel, 6:22951
**Photoionization**
Review of many-body calculations, 6:22754 (ANL—80-126)
**ARGON 40 REACTIONS**
**Inelastic Scattering**
Exploratory studies on relativistic heavy-ion central collisions, 6:22819
**Particle Production**
Exploratory studies on relativistic heavy-ion central collisions, 6:22819
**ARGON IONS**
**Collisions**
Laser fluorescence spectroscopy of sputtered zirconium atoms, 6:22803
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**Dissociation Energy**
Geometry and spectral properties of $Ne^+_3$, $Ar^+_3$, $Kr^+_3$, and $Xe^+_3$, 6:22793
**S States**
Correlation and relativistic effects in hole states, 6:22758 (ANL—80-126)
**ARGON OXIDES**
**Emission Spectra**
Matrix interactions with rare-gas oxide excimers, 6:22747
**Photoluminescence**
Matrix interactions with rare-gas oxide excimers, 6:22747
**ARIZONA**
**Electric Power**
Correcting for truncation bias in the analysis of experiments in time-of-day pricing of electricity, 6:22139
**Geochemical Surveys**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Geothermal Resources**
Evaluation of geothermal energy in Arizona. Arizona geothermal planning/commercialization team. Quarterly topical progress report, July 1-September 30, 1980, 6:21955 (DOE/RA/50076—T3)
**ARKANSAS POWER-LIGHT-2 REACTOR**
*See ARKANSAS-2 REACTOR*
**ARKANSAS-2 REACTOR**
**Fuel Cycle**
Evaluation and demonstration of methods for improved nuclear-fuel utilization. First semi-annual progress report, inception to June 30, 1980, 6:22046 (DOE/ET/34013—T1)
**Fuel Management**
Evaluation and demonstration of methods for improved nuclear-fuel utilization. First semi-annual progress report, inception to June 30, 1980, 6:22046 (DOE/ET/34013—T1)
**AROMATICS**
*See also BENZENE*
*BIPHENYL*
*CONDENSED AROMATICS*
*PHENOLS*
*POLYCYCLIC AROMATIC HYDROCARBONS*
*QUINONES*
**Mass Spectroscopy**
Hydrocarbon type analysis of jet fuels by $^1H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)
**NMR Spectra**
Hydrocarbon type analysis of jet fuels by $^1H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)
**Stereochemistry**
Restricted rotation in hydroxyphenyl ketones and formaldehydes, 6:22385
**ARSENIC**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Leaching**
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
**ASHES**
*See also FLY ASH*
**Evaporation**
Coal combustion studies. Task 4a, 6:21560 (DOE/ET/15518—3)
**ASIA**
*See also JAPAN*
*SRI LANKA*
**Geothermal Resources**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)
**ASPHALTENES**
**Chemical Analysis**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**ASPHALTS**
*See also ASPHALTENES*
**Chemical Analysis**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**ASTROCYTOMAS**
*See NEOPLASMS*
**ATMOSPHERIC EXPLOSIONS**
**Fallout**
Radiochemical data collected on events from which radioactivity escaped beyond the borders of the Nevada test range complex, 6:22529 (UCRL—52934)
**Radioactivity**
Radiochemical data collected on events from which radioactivity escaped beyond the borders of the Nevada test range complex, 6:22529 (UCRL—52934)
**Shock Waves**
Project PROPA-GATOR: intermediate range explosion airblast propagation measurements, 6:22526 (SAND—80-1880C)
**ATOM COLLISIONS**
*See also ATOM-MOLECULE COLLISIONS*
*ION-ATOM COLLISIONS*
Theoretical investigation and calculation of certain atomic and molecular processes important in the formation and destruction of excited stable gas molecules (or excimers). Final report, October 1, 1978-November 30, 1979, 6:22771 (DOE/DP/40017—T1)
**ATOMIC BEAMS**
**Beam Monitoring**
Spatial mapping of concentrations in pulsed and continuous atom sources, 6:22401
**ATOMIC BOMBS**
*See NUCLEAR WEAPONS*
**ATOMIC EXPLOSIONS**
*See NUCLEAR EXPLOSIONS*
**ATOMIC MODELS**
**Bound State**
State-of-the-art for multiconfiguration Dirac-Fock calculations, 6:22753 (ANL—80-126)
**Configuration Interaction**
Derivation of a configuration space Hamiltonian for heavy atoms: three body potentials, 6:22750 (ANL—80-126)
**Electron Correlation**
Atomic physics of strongly correlated systems, 6:22770 (CONF-810432—4)

Review of atomic structure calculations, 6:22767 (ANL—80-126)
**Energy-Level Transitions**
Application of discrete basis set methods to the Dirac equation, 6:22756 (ANL—80-126)
Relativistic many-body theory of atomic transitions: the relativistic equation-of-motion approach, 6:22759 (ANL—80-126)
**Hartree-Fock Method**
Quantum electrodynamics and the relativistic theory of many-electron atoms, 6:22749 (ANL—80-126)
State-of-the-art for multiconfiguration Dirac-Fock calculations, 6:22753 (ANL—80-126)
**Lamb Shift**
Quantum electrodynamics of high-Z few-electron atoms, 6:22751 (ANL—80-126)
Summary of QED session, 6:22766 (ANL—80-126)
**Many-Body Problem**
Review of many-body calculations, 6:22754 (ANL—80-126)
**Meetings**
Workshop on foundations of the relativistic theory of atomic structure, 6:22748 (ANL—80-126)
**Perturbation Theory**
Review of many-body calculations, 6:22754 (ANL—80-126)
**Quantum Electrodynamics**
Are we ready to test QED in two-electron ions, 6:22757 (ANL—80-126)
Summary of QED session, 6:22766 (ANL—80-126)
Workshop on foundations of the relativistic theory of atomic structure, 6:22748 (ANL—80-126)
**Random Phase Approximation**
Atomic structure calculations using the relativistic random phase approximation, 6:22755 (ANL—80-126)
**Schroedinger Equation**
Calculations of relativistic effects in atoms and molecules from the Schroedinger wave function, 6:22752 (ANL—80-126)

**ATOMIC SHELLS**
*See ELECTRONIC STRUCTURE*

**ATOMIC WEAPONS**
*See NUCLEAR WEAPONS*

**ATOM-MOLECULE COLLISIONS**
**Numerical Analysis**
Parabolic tunneling calculations, 6:22810
**Tunneling**
Parabolic tunneling calculations, 6:22810

**ATOMS**
*See also ISOELECTRONIC ATOMS*
**Electronic Structure**
Summary on experiments, 6:22768 (ANL—80-126)
**Inner-Shell Ionization**
Inner shell energies: experimental problems, 6:22763 (ANL—80-126)

**ATTACHED GREENHOUSES**
**Performance**
Performance of the solarium-assisted dormitory at the White Mountain School, Littleton, NH, 6:21918

**AURORAL ZONES**
**Radioecho**
Measurements of long delayed radio echoes in the auroral zone, 6:22746

**AUSTRALIA**
**Geothermal Resources**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)

**AUTOMOBILES**
**Control Systems**
Automotive electronics, 6:22263
**Electronic Equipment**
Automotive electronics, 6:22263
**Fuel Consumption**
Model simplification: a case study of end use demand modeling in the transportation sector, 6:22227 (LA-UR—81-813)
**Fuel Economy**
Model simplification: a case study of end use demand modeling in the transportation sector, 6:22227 (LA-UR—81-813)

**AUTOMOTIVE FUELS**
*See also GASOLINE*
*HYDROGEN FUELS*
**Combustion**
Chemical physics of catalysis. Residium upgrading and coking. Chemistry of engine combustion deposits, 6:21582

**AUTOTHERMAL REFORMER PROCESSES**
**Mathematical Models**
Investigation of carbon-formation mechanisms and fuel-conversion rates in the adiabatic reformer. Annual report, March 19, 1980-March 19, 1981, 6:22161 (DOE/MC/14395—T1)

**AUXINS**
**Correlations**
Osmoregulation in the Avena coleoptile in relation to auxin and growth, 6:22662

**AWAY-FROM-REACTOR STORAGE**
**Evaluation**
Spent-fuel dry-storage-concept evaluation, 6:21683 (RHO-CD—972)
**Physical Protection**
Analysis of protection requirements for away-from-reactor spent fuel storage facilities, 6:21650 (SAND—81-0605C)
**Regional Analysis**
Logistics characterization for regional spent fuel repositories concept, 6:21677 (ONWI—124)

## B

**BACA GEOTHERMAL FIELD**
**Geothermal Power Plants**
Baca Geothermal Demonstration Project. Quarterly technical progress report, April 1-June 30, 1980, 6:21970 (DOE/ET/27163—1)
**Institutional Factors**
Baca Geothermal Demonstration project legal and regulatory challenges. First semi-annual report for period through June 30, 1980, 6:21965 (DOE/ET/27163—2)
**Legal Aspects**
Baca Geothermal Demonstration project legal and regulatory challenges. First semi-annual report for period through June 30, 1980, 6:21965 (DOE/ET/27163—2)

**BACILLUS SUBTILIS**
**Biological Radiation Effects**
Measurement of pyrimidine dimers in spheroplasts of Bacillus subtilis, 6:22701

**BACK CONTACT SOLAR CELLS**
**Design**
Interdigitated back contact solar cell with high-current collection, 6:21774 (SAND—80-2206C)
**Efficiency**
Interdigitated back contact solar cell with high-current collection, 6:21774 (SAND—80-2206C)

**BACTERIA**
*See also CLOSTRIDIUM*
*SALMONELLA*
**Cell Cultures**
Use of microorganisms in enhanced oil recovery, 6:21569 (DOE/BC/10300—10)
**Productivity**
Treatment of coal coking and coal gasification wastewaters, 6:22651

**BAG MODEL**
**Mass Spectra**
Asymptotic mass spectrum and thermodynamics of the Abelian bag model, 6:22841
**Thermodynamic Model**
Asymptotic mass spectrum and thermodynamics of the Abelian bag model, 6:22841

**BANKS**
*See COMMERCIAL BUILDINGS*

**BARIUM**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)

**BARYON OCTETS**
**Magnetic Moments**
Precise measurement of the $J^0$ magnetic moment, 6:22818
**BASALT**
**Thermal Conduction**
Finite element model for heat conduction in jointed rock masses, 6:21684 (SAND—80-2016)
**Waste-Rock Interactions**
Hydrothermal interaction of a ceramic waste form with basalt, 6:22294 (CONF-8005107—)
**BATTERIES (ELECTRIC)**
*See ELECTRIC BATTERIES*
**BEAGLES**
**Biological Radiation Effects**
Cumulative survival statistics for Segment III beagles of the CRHL Long-Term Study, 6:22675 (FDA—81-8042)
Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age, 6:22677 (FDA—81-8042)
Malignancy as a cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22678 (FDA—81-8042)
Malignant lymphomas in beagles exposed to low level radiation, 6:22681 (FDA—81-8042)
Principal disease or cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22676 (FDA—81-8042)
**Litter Size**
Effect of radiation on gestation periods in dams of Segment III beagles, 6:22684 (FDA—81-8042)
**Mortality**
Incidence of convulsive seizures in Segment III beagles, 6:22688 (FDA—81-8042)
**Parturition**
Effect of radiation on gestation periods in dams of Segment III beagles, 6:22684 (FDA—81-8042)
**Perinatal Irradiation**
Atrophic thyroiditis in long-term Segment III beagles, 6:22679 (FDA—81-8042)
Cardiovascular studies in long-term Segment III beagles sacrificed at 8 years of age, 6:22687 (FDA—81-8042)
Case report: study of a beagle with a malignant ectopic thyroid tumor, 6:22692 (FDA—81-8042)
CSU-FDA Collaborative Radiological Health Laboratory annual report 1979, 6:22674 (FDA—81-8042)
Cumulative probability of occurrence for ocular lesions in Segment III dogs, 6:22682 (FDA—81-8042)
Incidence of convulsive seizures in Segment III beagles, 6:22688 (FDA—81-8042)
Ocular lesions in irradiated beagles, 6:22690 (FDA—81-8042)
Radiation effects on brain weight and gonad weight in Segment II beagles, 6:22689 (FDA—81-8042)
Reduction in eye volume after prenatal or neonatal irradiation, 6:22683 (FDA—81-8042)
Renal alterations in Segment II and III perinatally irradiated beagles, 6:22691 (FDA—81-8042)
Renal function changes associated with aging and ionizing radiation: a summary, 6:22693 (FDA—81-8042)
Testicular atrophy and neoplasia in Segment III beagles sacrificed at 5 and 8 years of age, 6:22686 (FDA—81-8042)
Thyroid neoplasia in long-term Segment III beagles, 6:22680 (FDA—81-8042)
**Prenatal Irradiation**
Atrophic thyroiditis in long-term Segment III beagles, 6:22679 (FDA—81-8042)
Cardiovascular studies in long-term Segment III beagles sacrificed at 8 years of age, 6:22687 (FDA—81-8042)
CSU-FDA Collaborative Radiological Health Laboratory annual report 1979, 6:22674 (FDA—81-8042)
Cumulative probability of occurrence for ocular lesions in Segment III dogs, 6:22682 (FDA—81-8042)
Effect of prenatal irradiation on total litter birth weight, 6:22685 (FDA—81-8042)
Incidence of convulsive seizures in Segment III beagles, 6:22688 (FDA—81-8042)
Ocular lesions in irradiated beagles, 6:22690 (FDA—81-8042)
Radiation effects on brain weight and gonad weight in Segment II beagles, 6:22689 (FDA—81-8042)
Reduction in eye volume after prenatal or neonatal irradiation, 6:22683 (FDA—81-8042)
Testicular atrophy and neoplasia in Segment III beagles sacrificed at 5 and 8 years of age, 6:22686 (FDA—81-8042)
Thyroid neoplasia in long-term Segment III beagles, 6:22680 (FDA—81-8042)
**Survival Curves**
Cumulative survival statistics for Segment III beagles of the CRHL Long-Term Study, 6:22675 (FDA—81-8042)
**Temperature Effects**
Effect of radiation on gestation periods in dams of Segment III beagles, 6:22684 (FDA—81-8042)
**BEAM DYNAMICS**
*(Particle beam motion inside an accelerator.)*
*See also BEAM-BEAM INTERACTIONS*
**Diagnostic Techniques**
Optical beam diagnostics on PEP, 6:22475 (SLAC-PUB—2683)
**Orbits**
Mathematical models for the control program of the SLAC linear collider, 6:22472 (SLAC-PUB—2672)
**BEAM FOCUSING MAGNETS**
**Design**
Design of focussing and guide structures for charged particle beams using rare earth cobalt permanent magnets, 6:22492 (LBL—12552)
**Permanent Magnets**
Design of focussing and guide structures for charged particle beams using rare earth cobalt permanent magnets, 6:22492 (LBL—12552)
**Solenoids**
Study of instabilities and emittance growth in periodic focusing systems for intense beams. Progress report, Technical report No. PP 81-198, 6:22467 (DOE/ER/05940—2)
**BEAM MONITORING**
**Equipment**
Spatial mapping of concentrations in pulsed and continuous atom sources, 6:22401
**BEAM TRANSPORT**
**Computer Codes**
Mathematical models for the EPIC code, 6:22859 (UCID—19055)
**BEAM-BEAM INTERACTIONS**
**Beam Dynamics**
Experimental observations and theoretical models for beam-beam phenomena, 6:22478 (SLAC-PUB—2700)
**BEANS**
**Sensitivity**
Effects of $SO_2$ dosage kinetics and exposure frequency on photosynthesis and transpiration of kidney beans (Phaseolus vulgaris L.), 6:22712
**BEAVER VALLEY-1 REACTOR**
**Environmental Effects**
1980 annual radiological environmental report. Volume 2, 6:22057 (DOE/PN/00293—T1)
**BEES**
*See INSECTS*
**BENZENE**
**Biodegradation**
Role of biodegradation kinetics in predicting environmental fate, 6:22589
**Vibrational States**
Collisional redistribution of vibrational energy in $CO_2$-laser-excited benzene, 6:22339
**BENZOPYRENE**
**Liquid Column Chromatography**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**Mass Spectroscopy**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**Metabolism**
Specificity of chemiluminescence in the metabolism of benzo[a]pyrene to its carcinogenic diol epoxide, 6:22615
**BENZOPYRROLES**
*See INDOLES*

**BERKELEY BEVALAC**
*See BEVALAC*
**BERKELIUM 249**
**Chemical Preparation**
Techniques of microchemistry and their applications to some transcurium elements at Berkeley and Oak Ridge (Micro- to milligram scale), 6:22412
**Spectrophotometry**
Techniques of microchemistry and their applications to some transcurium elements at Berkeley and Oak Ridge (Micro- to milligram scale), 6:22412
**BERYLLIUM**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**BERYLLIUM 9 TARGET**
**Proton Reactions**
Polarization of $S^+$ hyperons produced by 400-GeV protons, 6:22821
**BERYLLIUM COMPOUNDS**
**Mutagenesis**
Quantitative mammalian cell mutagenesis and a preliminary study of the mutagenic potential of metallic compounds, 6:22715
**BERYLLIUM IONS**
**Oscillator Strengths**
Atomic structure calculations using the relativistic random phase approximation, 6:22755 (ANL—80-126)
**BERYLLIUM MODERATORS**
*See BERYLLIUM*
**BETA II DEVICES**
**Research Programs**
Mirror fusion. Quarterly report, July-September 1980, 6:22887 (UCAR—10060-80-3)
**BEVALAC**
**Beam Monitors**
Metallic wedge degraders for rapid energy measurement of Bevalac heavy ion beams, 6:22469 (LBL—11726)
**Beam Transport**
Automatic tuning of the LBL Bevalac transfer line, 6:22468 (LBL—11580)
**Radiotherapy**
Operations experience at the Bevalac radiotherapy facility, 6:22491 (LBL—11725)
**Research Programs**
Nuclear science. Annual report, July 1, 1979-June 30, 1980, 6:22844 (LBL—11588)
**Uses**
Physics and medicine: the Bevatron/Bevalac experience, 1979-1980, 6:22490 (LBL—11719)
**BEVATRON**
*(6.2-GeV proton synchrotron at LBL.)*
**Uses**
Physics and medicine: the Bevatron/Bevalac experience, 1979-1980, 6:22490 (LBL—11719)
**BIOCHEMISTRY**
**Electrophoresis**
High-resolution two-dimensional electrophoretic mapping of human proteins, 6:22618
**BIODEGRADATION**
**Biochemical Reaction Kinetics**
Role of biodegradation kinetics in predicting environmental fate, 6:22589
**Mathematical Models**
Biotransformation and fate of chemicals in the aquatic environment (Lead abstract), 6:22582
Modeling the environmental fate of synthetic organic chemicals, 6:22590
**Measuring Methods**
Biodegradation tests: use and value, 6:22362
**Reaction Kinetics**
Quantitative expression of biotransformation rate, 6:22591
**BIOLOGICAL EVOLUTION**
**Biological Effects**
Study of mathematical models of mutation and selection in multi-locus systems. Annual progress report, October 1, 1980-September 30, 1981, 6:22637 (DOE/EV/02472—T1)
**Mathematical Models**
Study of mathematical models of mutation and selection in multi-locus systems. Annual progress report, October 1, 1980-September 30, 1981, 6:22637 (DOE/EV/02472—T1)
**BIOLOGICAL MODELS**
Natural variability as a source of error in model predictions, 6:22612
**BIOLOGICAL PATHWAYS**
**Tracer Techniques**
Comparison of $^{13}C$ nuclear magnetic resonance and $^{14}C$ tracer studies of hepatic metabolism, 6:22613
**BIOLOGICAL RADIATION EFFECTS**
**Research Programs**
CSU-FDA Collaborative Radiological Health Laboratory annual report 1979, 6:22674 (FDA—81-8042)
**BIOMASS CONVERSION PLANTS**
**Feasibility Studies**
Pahoa geothermal industrial park. Engineering and economic analysis for direct applications of geothermal energy in an industrial park at Pahoa, Hawaii, 6:21977 (DOE/ET/27233—T3)
**Geothermal Process Heat**
Pahoa geothermal industrial park. Engineering and economic analysis for direct applications of geothermal energy in an industrial park at Pahoa, Hawaii, 6:21977 (DOE/ET/27233—T3)
**BIOSYNTHESIS**
**Inhibition**
Action of protein synthesis inhibitors in blocking electrogenic $H^+$ efflux from corn roots, 6:22663
**BIPHENYL**
**Nuclear Magnetic Resonance**
Study of liquid crystal conformation by multiple quantum NMR: n-pentyl cyanobiphenyl, 6:22391
**BIRTH**
*See PARTURITION*
**BITUMINOUS COAL**
**Toxicity**
Pathologic changes associated with experimental exposure of rats to coal dust, 6:22707
**BLACK SEA**
**Geology**
Rate of denudation in Black Sea source area, 6:22561 (CONF-8009140—)
**Orogenesis**
Rate of denudation in Black Sea source area, 6:22561 (CONF-8009140—)
**BLACK SHALES**
**Exploitation**
Devonian shale, 6:21606
**Stratigraphy**
Stratigraphic cross section of the upper Devonian Perrysburg and Java formations and thier equivalents, Northwestern Pennsylvania, 6:21598 (METC/EGSP—14)
Stratigraphic cross sections showing members of the New Albany Shale (Devonian and Mississippian) in Indiana, 6:21599 (METC/EGSP—816)
**BLANKETS (BREEDING)**
*See BREEDING BLANKETS*
**BLASTS**
*See EXPLOSIONS*
**BLOOD PRESSURE**
**Genetic Variability**
Familial aggregation of blood pressure and weight in adoptive families: I. Comparisons of blood pressure and weight statistics among families with adopted, natural, or both natural and adopted children, 6:22641
**BOILERS**
**Design**
Analysis of flow, gas-particle radiation, and particulate deposition in radiant boilers, 6:22143 (ANL/MHD—81-5)

Rivesville multicell fluidized-bed boiler. Annual technical progress report, July 1979-June 1980, 6:22460 (DOE/MC/16230—154)

**Fluid Flow**
Analysis of flow, gas-particle radiation, and particulate deposition in radiant boilers, 6:22143 (ANL/MHD—81-5)

**Fluidized-Bed Combustors**
Rivesville multicell fluidized-bed boiler. Annual technical progress report, July 1979-June 1980, 6:22460 (DOE/MC/16230—154)

**Fouling**
Pilot plant tests of peat for direct combustion in utility boilers, 6:21563

**Heat Transfer**
Analysis of flow, gas-particle radiation, and particulate deposition in radiant boilers, 6:22143 (ANL/MHD—81-5)

**Mass Transfer**
Analysis of flow, gas-particle radiation, and particulate deposition in radiant boilers, 6:22143 (ANL/MHD—81-5)

**Materials**
Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)

**Performance**
Rivesville multicell fluidized-bed boiler. Annual technical progress report, July 1979-June 1980, 6:22460 (DOE/MC/16230—154)

**BOILING WATER REACTORS**
*See BWR TYPE REACTORS*

**BOLTS**
*See FASTENERS*

**BONE CELLS**
**Collagen**
Analysis of cells isolated from bone cultured on collagen gels and polystyrene culture dishes, 6:22631 (UR—3490/LCP-22)

**BONE MARROW**
**Biopsy**
Plastic-embedded human marrow biopsy specimens, 6:22646

**BONES**
*See SKELETON*

**BOREHOLES**
**Crack Propagation**
Model studies of explosive well stimulation techniques, 6:21575

**Fracture Properties**
Model studies of explosive well stimulation techniques, 6:21575

**Stresses**
Hydraulic fracturing and overcoring stress measurements in a deep borehole at the Stripa Test Mine, Sweden, 6:21673 (LBL—12478)

**BORON**
**Chemical Vapor Deposition**
Mechanical properties of chemical vapor deposited coatings for fusion reactor application, 6:22923

**Leaching**
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)

**Mechanical Properties**
Mechanical properties of chemical vapor deposited coatings for fusion reactor application, 6:22923

**BORON CARBIDES**
**Erosion**
Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report, 6:21497 (DOE/ET/13537—T3)

**Grinding**
New era for ultrasonic impact grinding, 6:22422 (LA-UR—81-1316)

**BORON COMPLEXES**
**Electronic Structure**
Electronic structural properties and photosynthesis, 6:21810

**Structural Chemical Analysis**
Electronic structural properties and photosynthesis, 6:21810

**BORON HYDRIDES**
**Molecular Structure**
Generalized molecular orbital theory: a limited multiconfiguration self-consistent-field-theory, 6:22780 (LBL—12157)

**BORON ISOTOPES**
**Mass Spectroscopy**
Quadrupole mass spectrometer for a mobile laboratory to measure isotope ratios, 6:21693 (CONF-810548—3)

**BOUNDARY-VALUE PROBLEMS**
**Finite Element Method**
Finite element method with nonuniform mesh sizes for unbounded domains, 6:22986

**BRAIN**
**Biological Radiation Effects**
Radiation effects on brain weight and gonad weight in Segment II beagles, 6:22689 (FDA—81-8042)

**BREASTS**
*See MAMMARY GLANDS*

**BREEDER REACTORS**
*See also LMFBR TYPE REACTORS*
*LWBR TYPE REACTORS*
Economic impact of a laser-fusion breeder on the U.S. energy economy, 6:22910

**BREEDING BLANKETS**
**Heterogeneous Effects**
MIT LMFBR blanket research project. Quarterly progress report, October 1, 1980-December 31, 1980, 6:22035 (DOE/ET/37241—45)

**BRITISH GAS CORPORATION PROCESS**
*See CRG PROCESSES*

**BROMINE**
**Activation Analysis**
Flagstaff $1^0$ x $2^0$ NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon $1^0$ x $2^0$ NTMS area Arizona: data report, 6:21638 (GJBX—138(81))

**BUILDERS**
**Attitudes**
Conventional HVAC contractors: convincing the competition to join the solar movement, 6:21755

**BUILDING MATERIALS**
*See also CEMENTS*
*CONCRETES*

**Energy Consumption**
Handbook of energy use for building construction, 6:22190 (DOE/CE/20220—1)

**BUILDINGS**
*See also ANIMAL SHELTERS*
*APARTMENT BUILDINGS*
*COMMERCIAL BUILDINGS*
*EARTH-COVERED BUILDINGS*
*GREENHOUSES*
*HOUSES*
*OFFICE BUILDINGS*
*PUBLIC BUILDINGS*
*RESIDENTIAL BUILDINGS*
*SCHOOL BUILDINGS*

**Construction**
Handbook of energy use for building construction, 6:22190 (DOE/CE/20220—1)

**Daylighting**
Innovative, efficient daylighting designs, 6:22215

**Design**
Phase two report for the development of energy performance standards for new buildings. Appendix D. Energy conscious designs, 6:22197 (DOE/TIC—11456)

**Energy Analysis**
Human comfort and auxiliary control considerations in passive solar structures, 6:21921

**Energy Conservation**
UCC-ND energy conservation program to date, 6:22232 (CONF-8003114—)

**Energy Efficiency Standards**
Improved data and procedures needed for development and implementation of building energy performance standards, 6:22204 (EMD—81-2)
Phase two report for the development of energy performance standards for new buildings. Appendix D. Energy conscious designs, 6:22197 (DOE/TIC—11456)

**Energy Management**
Do's and don't in energy conservation design, 6:22114 (CONF-8003114—)

**Heat Storage**
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)
**Measuring Instruments**
Test building instrumentation cooperative agreement: heating/daylighting prototype development. Phase II. Passive and hybrid solar manufactured building project. Project status report No. 2, April 16, 1980-March 16, 1981, 6:21850 (DOE/CS/30367—T1)
**Natural Convection**
Natural convection in room geometries, 6:21920
**Off-Peak Energy Storage**
Use of the atop system in the control of an off-peak storage device, 6:22221
**Radiative Cooling**
Passive nocturnal cooling resource assessment using validated heat transfer equations, 6:21889
**Shading**
Guide to passive cooling: model shading ordinance, 6:22168
**Solar Space Heating**
Building space heating: active systems, 6:21915
Human comfort and auxiliary control considerations in passive solar structures, 6:21921
Solar Energy System Economic Evaluation final report for Colt Pueblo, Pueblo, Colorado, 6:21855 (DOE/NASA/CR—161725)
**Solar Water Heating**
Solar Energy System Economic Evaluation final report for Colt Pueblo, Pueblo, Colorado, 6:21855 (DOE/NASA/CR—161725)
**Space HVAC Systems**
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)
**Thermal Analysis**
Natural convection in room geometries, 6:21920

**BUILDINGS (CONTAINMENT)**
*See CONTAINMENT BUILDINGS*

**BUTANE**
**Charge Exchange**
Long range transfer of positive charge between dopant molecules in a rigid glassy matrix, 6:22381

**BWR TYPE REACTORS**
**Fuel Assemblies**
New developments in nondestructive measurement and verification of irradiated lwr fuels, 6:21716
**Loss of Coolant**
Method for chug classification, 6:22083 (UCRL—85707)
**Reactor Safety**
Learning function in nuclear reactor operation and its implications for siting policy, 6:22081 (ORAU/IEA—81-4(M))

## C

**CABLES**
**Mechanical Vibrations**
Guy-cable design and damping for vertical-axis wind turbines, 6:21986 (SAND—80-2669)
**Stress Analysis**
Guy-cable design and damping for vertical-axis wind turbines, 6:21986 (SAND—80-2669)

**CADMIUM**
**Corrosive Effects**
Stress corrosion cracking of zircaloy by metal iodides and cadmium, 6:22274 (LBL—12548)

**CADMIUM COMPLEXES**
**Structural Chemical Analysis**
$^{15}N$ NMR study of complexation of 1-methylimidazole by zinc(II) and cadmium(II) in aqueous soltuion, 6:22389

**CADMIUM SELENIDES**
**Photochemistry**
Laser-induced photoelectrochemistry. Time-resolved coulostatic-flash studies of cadmium sulfide electrodes, 6:21797

**CADMIUM SULFIDE SOLAR CELLS**
**Design**
Design and fabrication of high efficiency thin film CdS/Cu/sub 2/S solar cells, 6:21807
**Efficiency**
Cadmium sulfide-copper sulfide heterojunction cell research. Annual report, September 1, 1979-August 31, 1980, 6:21785 (SERI/PR—8309-1-T4)
**Electrical Properties**
Cadmium sulfide-copper sulfide heterojunction cell research. Annual report, September 1, 1979-August 31, 1980, 6:21785 (SERI/PR—8309-1-T4)
Cadmium sulfide-copper sulfide heterojunction cell research. Final report, September 1, 1978-August 31, 1979, 6:21794 (SERI/TR—8063-1-T2)
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, December 1, 1978-March 1, 1979, 6:21783 (SERI/PR—8063-1-T3)
**Fabrication**
Cadmium sulfide-copper sulfide heterojunction cell research. Annual report, September 1, 1979-August 31, 1980, 6:21785 (SERI/PR—8309-1-T4)
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, March 1-June 1, 1979, 6:21782 (SERI/PR—8063-1-T1)
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, December 1, 1978-March 1, 1979, 6:21783 (SERI/PR—8063-1-T3)
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, September 1-December 1, 1978, 6:21784 (SERI/PR—8063-1-T4)
Design and fabrication of high efficiency thin film CdS/Cu/sub 2/S solar cells, 6:21807
**Performance**
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, March 1-June 1, 1979, 6:21782 (SERI/PR—8063-1-T1)
Cadmium sulfide-copper sulfide heterojunction cell research. Final report, September 1, 1978-August 31, 1979, 6:21794 (SERI/TR—8063-1-T2)
Cadmium sulfide-copper sulfide heterojunction cell research. Quarterly progress report, September 1-December 1, 1978, 6:21784 (SERI/PR—8063-1-T4)

**CADMIUM SULFIDES**
**Photochemistry**
Laser-induced photoelectrochemistry. Time-resolved coulostatic-flash studies of cadmium sulfide electrodes, 6:21797

**CALCINED WASTES**
**Chemical Radiation Effects**
Radiation damage in natural materials: implications for radioactive waste forms, 6:21655 (CONF-8005107—)
**Physical Radiation Effects**
Radiation damage in natural materials: implications for radioactive waste forms, 6:21655 (CONF-8005107—)
**Stability**
Hydrothermal interaction of a ceramic waste form with basalt, 6:22294 (CONF-8005107—)
**Waste-Rock Interactions**
Hydrothermal interaction of a ceramic waste form with basalt, 6:22294 (CONF-8005107—)

**CALCIUM**
**Leaching**
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
**Metabolism**
Total and exchangeable calcium in mitogen-treated lymphocytes, 6:22644

**CALCIUM FLUORIDES**
**Calcination**
Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry, 6:22340
**Coprecipitation**
Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry, 6:22340
**CALIFORNIA**
**Fuel Consumption**
Liquid fuel conservation: an opportunity for local governments, 6:22223
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**CALIFORNIUM 249**
**Chemical Preparation**
Techniques of microchemistry and their applications to some transcurium elements at Berkeley and Oak Ridge (Micro- to milligram scale), 6:22412
**Spectrophotometry**
Techniques of microchemistry and their applications to some transcurium elements at Berkeley and Oak Ridge (Micro- to milligram scale), 6:22412
**CALORIMETERS**
**Design**
Fusion energy calorimeter for the tokamak fusion test reactor, 6:22885 (PPPL—1791)
**CALORIMETERS (PARTICLE)**
*See SHOWER COUNTERS*
**CANADA**
**Pollution Regulations**
Nitrilotriacetate: hindsight and gunsight, 6:22592
Role of biodegradability in the environmental evaluation of polychlorinated biphenyls and chemicals in general, 6:22600
**CANCER**
*See NEOPLASMS*
**CANONICAL EQUATIONS**
*See DIFFERENTIAL EQUATIONS*
**CAP ROCK**
**Chemical Composition**
Using presence of calcite cap rock in shales to predict occurrence of reservoirs composed of leached secondary porosity in the geopressured zone. Annual report, June 1, 1980-October 31, 1980, 6:21958 (DOE/ET/27111—2)
**CARBAZOLES**
**Liquid Column Chromatography**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**Mass Spectroscopy**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**CARBON**
*See also DIAMONDS*
*GRAPHITE*
*PYROLYTIC CARBON*
**Atmospheric Chemistry**
Role of black carbon in the organic chemistry of atmospheric aerosols, 6:22532 (LBL—12540)
**Biogeochemistry**
Fluxes of organic matter in rivers relative to the global carbon cycle, 6:22567 (CONF-8009140—)
**Deposition**
Deposition of riverborne organic carbon in floodplain wetlands and deltas, 6:22564 (CONF-8009140—)
**Desorption**
Argon ion impact desorption cross sections of chlorine and carbon from nickel, 6:22951
**Environmental Transport**
Carbon dioxide effects research and assessment program: flux of organic carbon by rivers to the oceans (Lead abstract), 6:22558 (CONF-8009140—)
Chemical indicators of organic river sources in rivers and estuaries, 6:22563 (CONF-8009140—)
Flux of organic carbon to the oceans: some hydrologic considerations, 6:22565 (CONF-8009140—)
River transport of organic carbon to the ocean, 6:22566 (CONF-8009140—)
Role of river-transported organic carbon in the global cycle, 6:22560 (CONF-8009140—)
Storage and transport of carbon by rivers, 6:22559 (CONF-8009140—)
Use of carbon isotope measurements to examine the movement of labile and refractory carbon in soil, 6:22555 (CONF-8009140—)
**Flow Rate**
Global carbon cycle: some minor sinks for $CO_2$, 6:22571 (CONF-8009140—)
**Geochemistry**
Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries, 6:22562 (CONF-8009140—)
**Organic Compounds**
Carbon dioxide effects research and assessment program: flux of organic carbon by rivers to the oceans (Lead abstract), 6:22558 (CONF-8009140—)
**Sedimentation**
Fate of sedimented organic carbon in estuaries, 6:22568 (CONF-8009140—)
**CARBON 11**
**Monitoring**
Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)
**CARBON 12**
**Isotope Ratio**
Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries, 6:22562 (CONF-8009140—)
**CARBON 12 TARGET**
**Alpha Reactions**
Evidence for giant E2 transitions in high-energy a-particle capture, 6:22848
**CARBON 13**
**Isotope Ratio**
Carbon dioxide effects research and assessment program: flux of organic carbon by rivers to the oceans (Lead abstract), 6:22558 (CONF-8009140—)
Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries, 6:22562 (CONF-8009140—)
Radiocarbon in New York Bight sediments and the use of carbon isotopes in delineating carbon sources, 6:22569 (CONF-8009140—)
Terrestrial sources of organic carbon, 6:22554 (CONF-8009140—)
Use of carbon isotope measurements to examine the movement of labile and refractory carbon in soil, 6:22555 (CONF-8009140—)
**Nuclear Magnetic Resonance**
Bio/organic analysis section, 6:22334 (ORNL—5738)
**CARBON 14**
**Isotope Ratio**
Carbon dioxide effects research and assessment program: flux of organic carbon by rivers to the oceans (Lead abstract), 6:22558 (CONF-8009140—)
Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries, 6:22562 (CONF-8009140—)
Radiocarbon in New York Bight sediments and the use of carbon isotopes in delineating carbon sources, 6:22569 (CONF-8009140—)
Terrestrial sources of organic carbon, 6:22554 (CONF-8009140—)
Use of carbon isotope measurements to examine the movement of labile and refractory carbon in soil, 6:22555 (CONF-8009140—)
**CARBON COMPOUNDS**
**Environmental Transport**
Terrestrial sources of organic carbon, 6:22554 (CONF-8009140—)
**Exchange Interactions**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1-c/Cl_3$, 6:22319
**Magnetic Susceptibility**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1-c/Cl_3$, 6:22319

**Neutron Diffraction**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319
**Spin Waves**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319

**CARBON CYCLE**
**Flow Rate**
Fate of terrestrial organic carbon in the coastal area, 6:22570 (CONF-8009140—)
**Global Aspects**
Carbon dioxide effects research and assessment program: flux of organic carbon by rivers to the oceans (Lead abstract), 6:22558 (CONF-8009140—)
Fluxes of organic matter in rivers relative to the global carbon cycle, 6:22567 (CONF-8009140—)
Global carbon cycle: some minor sinks for $CO_2$, 6:22571 (CONF-8009140—)
Role of river-transported organic carbon in the global cycle, 6:22560 (CONF-8009140—)

**CARBON DIOXIDE**
**Annual Variations**
Atmospheric carbon dioxide, the southern oscillation, and the weak 1975 El Nino, 6:22550
**Correlations**
Atmospheric carbon dioxide, the southern oscillation, and the weak 1975 El Nino, 6:22550
**Critical Temperature**
Effect of water upon the critical points of carbon dioxide and ethane, 6:22367
**Greenhouse Effect**
Study of the global energy balance, 6:22533 (UCRL—85958)
**Matrix Isolation**
Matrix interactions with rare-gas oxide excimers, 6:22747
**Meetings**
Carbon dioxide effects research and assessment program: flux of organic carbon by rivers to the oceans (Lead abstract), 6:22558 (CONF-8009140—)
**Phase Studies**
Displacement of oil by carbon dioxide. Final report, 6:21571 (DOE/ET/12082—9)
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576
**Separation Processes**
Membrane separation of a $CO_2$-$N_2$ mixture using steam, 6:22360

**CARBON DIOXIDE INJECTION**
**Mathematical Models**
Displacement of oil by carbon dioxide. Final report, 6:21571 (DOE/ET/12082—9)

**CARBON DIOXIDE LASERS**
**Alignment**
Alignment accuracy of the Helios $CO_2$ laser, 6:22965
Antares alignment gimbal positioner, 6:22915 (LA-UR—81-1394)
Helios $CO_2$ fusion laser alignment system, 6:22964
**Gain**
Small-signal-gain spectrum of an 1800 Torr $CO_2$ amplifier, 6:22434 (LA-UR—81-1232)
**Optical Systems**
In-situ optical breakdown: studies for a large $CO_2$ laser amplifier, 6:22914 (LA-UR—81-1245)
Temporal shaping of nanosecond $CO_2$ laser pulses in multiphoton saturable absorbers, 6:22916 (LA-UR—81-1404)

**CARBON IONS**
**Ion-Atom Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**Ion-Ion Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)

**CARBON MONOXIDE**
**Adsorption**
Co adsorption on Al-Zr at room temperature, 6:22926
Infrared spectra of carbon monoxide on evaporated nickel films: a low temperature thermal detection technique, 6:22379
**Air Pollution**
n-dimensional pattern recognition in environmental systems, 6:22540 (CONF-801045—)
**Auger Effect**
Analysis of transition metal carbonyl Auger line shapes, 6:22322
**Chemisorption**
Thermal desorption and UPS study of CO adsorbed on Cu-covered Ru (0001), 6:22289
**Desorption**
Thermal desorption and UPS study of CO adsorbed on Cu-covered Ru (0001), 6:22289
**Infrared Spectra**
Infrared spectra of carbon monoxide on evaporated nickel films: a low temperature thermal detection technique, 6:22379
**Monitoring**
Mobile source emission inventory, 6:22544 (EPA-AA-TEB—81-11)

**CARBON STEELS**
**Fatigue**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)
**Fracture Properties**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)
**Laser Welding**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)

**CARBON SULFIDES**
**Kerr Effect**
Ultraviolet phase conjugation and its practical implications, 6:22435 (LA-UR—81-1565)

**CARBONIC ACID DERIVATIVES**
**Toxicity**
Cytotoxicity and mutagenicity of alkylating agents in cultured mammalian cells (CHO/HGPRT system): mutagen treatment in the presence or absence of serum, 6:22714

**CARBONIC ANHYDRASE**
**Electrophoresis**
Electrophoretic variants in three Amerindian tribes: the Baniwa, Kanamari, and central Pano of western Brazil, 6:22640

**CARBONYLS**
**Auger Effect**
Analysis of transition metal carbonyl Auger line shapes, 6:22322

**CARBOXYLIC ACID ESTERS**
*See also METHACRYLIC ACID ESTERS*
**Hydrolysis**
Continuous chromatographic reactor, 6:22361
**Photolysis**
ESR study of electron reactions with esters and triglycerides, 6:22400
**Radiolysis**
ESR study of electron reactions with esters and triglycerides, 6:22400

**CARBOXYLIC ACID SALTS**
**Absorption Spectroscopy**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**Excited States**
Energy storage in organic photoisomers, 6:21809
**Isomerization**
Energy storage in organic photoisomers, 6:21809
**Photochemistry**
Energy storage in organic photoisomers, 6:21809

**CARBOXYLIC ACIDS**
**Absorption Spectroscopy**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**Chemical Reactions**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**Hydrolysis**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343
**Photolysis**
ESR study of electron reactions with carboxylic acids, ketones, and aldehydes in aqueous glasses, 6:22399
**6-CARBOXYURACIL**
*See OROTIC ACID*
**CARCINOGENESIS**
**Biological Pathways**
Chemical carcinogenesis. Chapter 12, 6:22717
**Mathematical Models**
Temporal aspects of tumorigenic response to individual and mixed carcinogens. Progress report, 6:22719 (DOE/EV/02737—9)
**Polycyclic Aromatic Hydrocarbons**
Temporal aspects of tumorigenic response to individual and mixed carcinogens. Progress report, 6:22719 (DOE/EV/02737—9)
**CARCINOGENS**
**Biological Effects**
Scanning electron microscopy of differentiated liver cells transformed in vitro by chemical carcinogens, 6:22635
**Interactions**
Interactions of radiation and chemical carcinogens, 6:22700
**CARDIOVASCULAR SYSTEM**
**Biological Radiation Effects**
Cardiovascular studies in long-term Segment III beagles sacrificed at 8 years of age, 6:22687 (FDA—81-8042)
**Dynamic Function Studies**
Cardiovascular studies in long-term Segment III beagles sacrificed at 8 years of age, 6:22687 (FDA—81-8042)
**CASCADE IMPACTORS**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**CATALYSIS**
Chemical physics of catalysis. Residium upgrading and coking. Chemistry of engine combustion deposits, 6:21582
Fundamentals of catalytic and thermal reactions. Catalysis for chemicals and fuels. Chemistry of enhanced oil recovery. Sulfur recovery and utilization, 6:21580
**CATALYSTS**
**Comparative Evaluations**
Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980, 6:21494 (DOE/ET/11429—T1)
**CATALYTIC RICH GAS PROCESS**
*See CRG PROCESSES*
**CATAPHORESIS**
*See ELECTROPHORESIS*
**CATARACTS**
**Radioinduction**
Cumulative probability of occurrence for ocular lesions in Segment III dogs, 6:22682 (FDA—81-8042)
**Scanning Electron Microscopy**
Energy dispersive x-ray analysis of human lens cataracts, 6:22647
**X-Ray Emission Analysis**
Energy dispersive x-ray analysis of human lens cataracts, 6:22647
**CATION EXCHANGE CAPACITY**
*See CATIONS*
**CATIONS**
**Membrane Transport**
Anionic detergents as divalent cation ionophores across black lipid membranes, 6:22627
**CELL CULTURES**
**Mutagenesis**
Cytotoxicity and mutagenicity of alkylating agents in cultured mammalian cells (CHO/HGPRT system): mutagen treatment in the presence or absence of serum, 6:22714
**CELL FLOW SYSTEMS**
**Resolution**
Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density, 6:22630 (CONF-8005164—1)
**CELL MEMBRANES**
**Biological Evolution**
Unit membrane redundancy in spherical structures within the ocular lens (Rabbits), 6:22669
**CELL NUCLEI**
**DNA**
Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density, 6:22630 (CONF-8005164—1)
**Shape**
Expectation values for low resolution flow slit scan prescreening: influence of nuclear shape and DNA density, 6:22630 (CONF-8005164—1)
**CELL PROLIFERATION**
**Biological Effects**
Variants of 3T3 cells lacking mitogenic response to the tumor promoter tetradecanoyl-phorbol-acetate, 6:22632
**CELLS (ANIMAL)**
*See ANIMAL CELLS*
**CELLS (BACTERIAL)**
*See BACTERIA*
**CEMENTS**
**Materials Testing**
Survey of concrete waste forms, 6:21659 (CONF-8005107—)
**Research Programs**
Survey of concrete waste forms, 6:21659 (CONF-8005107—)
**CENTRAL AMERICA**
**Energy Source Development**
Greater Caribbean Energy and Environment Future. Ad hoc working group report, Key Biscayne, Florida, October 26-28, 1980, 6:22104 (DOE/EV/10454—T1)
**CENTRAL HEATING PLANTS**
*See also DISTRICT HEATING*
**Employment**
Construction-en.ployment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities, 6:22100 (ANL/CNSV—19)
**CENTRAL NERVOUS SYSTEM**
*See also BRAIN*
**Biological Radiation Effects**
Incidence of convulsive seizures in Segment III beagles, 6:22688 (FDA—81-8042)
**CENTRAL RECEIVERS**
**Heat Pipes**
Preliminary heat pipe testing program. Final technical report, 6:21838 (DOE/SF/10756—1)
**CENTRIFUGE ENRICHMENT PLANTS**
**IAEA Safeguards**
International safeguards at the feed and withdrawal area of a gas centrifuge uranium enrichment plant, 6:21699
**CERAMICS**
**Fabrication**
Review of glass ceramic waste forms, 6:21664 (CONF-8005107—)
**Materials Testing**
Review of glass ceramic waste forms, 6:21664 (CONF-8005107—)
**Vapor Plating**
Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils, 6:21999 (DOE/ET/12292—T1)
**CERIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))

**CERIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**CERIUM PHOSPHATES**
**Crystal Structure**
Structure of cerium orthophosphate, a synthetic analogue of monazite, 6:22373
**Pelletizing**
Hot and cold pressing of $(La,Ce)PO_4$-based nuclear waste forms, 6:21658 (CONF-8005107—)
**CERMETS**
**Corrosion Resistance**
High level waste fixation in cermet form, 6:21663 (CONF-8005107—)
**Leaching**
High level waste fixation in cermet form, 6:21663 (CONF-8005107—)
**Thermal Conductivity**
High level waste fixation in cermet form, 6:21663 (CONF-8005107—)
**CESIUM**
**Adsorption**
Influence of waste solid on nuclide dispersal, 6:21662 (CONF-8005107—)
**Partition**
Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D, 6:21687 (UCRL—15347)
**Photon Transport**
Anomalous scattering of X-rays by cesium and cobalt measured with synchrotron radiation, 6:22857
**CESIUM HYDRIDES**
**Interatomic Forces**
Molecular potentials and relaxation dynamics, 6:22790 (UCRL—85577)
Molecular potentials and relaxation dynamics, 6:22791 (UCRL—85577(Rev.1))
**CESIUM IODIDES**
**Corrosive Effects**
Stress corrosion cracking of zircaloy by metal iodides and cadmium, 6:22274 (LBL—12548)
**CEYLON**
*See SRI LANKA*
**CHARM PARTICLES**
**Particle Decay**
Phenomenology of quark mixing and the Kobayashi-Maskawa model, 6:22822 (BNL—29468)
**CHARS**
**Combustion**
Effects of preignition on pulverized-coal combustion. Second quarterly report, 1 January 1981-31 March 1981 (Above 800K), 6:21562 (DOE/PC/30293—2)
**CHELATING AGENTS**
*See also EDTA*
*HEDTA*
*NTA*
Specific sequestering agents for the actinides, 6:22698
**CHEMICAL ANALYSIS**
*See also ALPHA SPECTROSCOPY*
*ELECTRON MICROPROBE ANALYSIS*
*GAMMA SPECTROSCOPY*
*ION MICROPROBE ANALYSIS*
*LASER SPECTROSCOPY*
*MASS SPECTROSCOPY*
*NEUTRON SPECTROSCOPY*
*RADIATION ABSORPTION ANALYSIS*
*RADIOCHEMICAL ANALYSIS*
*RADIOMETRIC ANALYSIS*
**Research Programs**
Analytical Chemistry Division. Annual progress report for period ending December 31, 1980, 6:22332 (ORNL—5738)
**CHEMICAL EXPLOSIVES**
*See also TATB*
*TNT*
**Detonations**
Detonation pressures of PBX-9404, composition B, PBX-9502, and nitromethane, 6:22523 (LA-UR—81-1067)
PHERMEX applications to study high-pressure flow and detonation waves, 6:22524 (LA-UR—81-1270)
**Impact Shock**
150mm launcher facility for shockwave compression experiments: a critical review and conceptual design study, 6:22527 (UCRL—15334)
**Performance Testing**
150mm launcher facility for shockwave compression experiments: a critical review and conceptual design study, 6:22527 (UCRL—15334)
Detonation pressures of PBX-9404, composition B, PBX-9502, and nitromethane, 6:22523 (LA-UR—81-1067)
**Production**
Formulation of PBX 9503, 6:22525 (MHSMP—81-25)
**Sensitivity**
150mm launcher facility for shockwave compression experiments: a critical review and conceptual design study, 6:22527 (UCRL—15334)
Formulation of PBX 9503, 6:22525 (MHSMP—81-25)
**Stability**
Formulation of PBX 9503, 6:22525 (MHSMP—81-25)
**CHEMICAL REACTION KINETICS**
**Spatial Dependence**
Stochastic flows in integral and fractal dimensions and morphogenesis, 6:22372
**CHEMICAL REACTIONS**
*See also DESULFURIZATION*
*FISCHER-TROPSCH SYNTHESIS*
*HYDROGENATION*
*PHOTOSYNTHESIS*
**Probability**
Inhibition of chemical reactions by a strong laser field, 6:22365
**Simulation**
Stochastic flows in integral and fractal dimensions and morphogenesis, 6:22372
**CHEMICAL REACTORS**
*See also RETORTS*
**Design**
Continuous chromatographic reactor, 6:22361
**Fluid Mechanics**
Gas/slurry flow in coal-liquefaction processes (fluid dynamics in 3-phase flow columns). Quarterly technical progress report, 1 July 1980-30 September 1980, 6:21498 (DOE/ET/14801—12)
**Multiphase Flow**
Gas/slurry flow in coal-liquefaction processes (fluid dynamics in 3-phase flow columns). Quarterly technical progress report, 1 July 1980-30 September 1980, 6:21498 (DOE/ET/14801—12)
**Risk Assessment**
Safety analysis of the CSTR-1 bench-scale coal liquefaction unit, 6:21504 (DOE/PC/30198—T3)
**CHEMISTRY**
*See also BIOCHEMISTRY*
**Auger Electron Spectroscopy**
Chemical information from Auger electron spectroscopy, 6:22348
**CHLORINATED ALIPHATIC HYDROCARBONS**
*See also PVC*
**Dissociation**
Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)
**Photochemistry**
Ultraviolet laser photochemistry of $CF_2Cl_2$, 6:22402
**Photolysis**
Development of advanced technologies for photochemical tritium recovery. Quarterly progress report, January 1, 1980-March 31, 1980, 6:22394 (UCID—18509-80-1)
**Photon-Molecule Collisions**
Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)
**CHLORINATED AROMATIC HYDROCARBONS**
**Biodegradation**
Role of biodegradability in the environmental evaluation of polychlorinated biphenyls and chemicals in general, 6:22600
**Chemical Radiation Effects**
Intramolecular electron transfer and dehalogenation of anion radicals. 2. Halonitroaromatic compounds, 6:22407

**CHLORINE**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Chemical Reaction Kinetics**
Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)
**Desorption**
Argon ion impact desorption cross sections of chlorine and carbon from nickel, 6:22951
**Photochemical Reactions**
Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)
**CHLORINE 37**
**Neutron Reactions**
Reactions of recoil $^{38}Cl$ in crystalline p-dichlorobenzenes, 6:22409
**CHLORINE 38**
**Hot Atom Chemistry**
Reactions of recoil $^{38}Cl$ in crystalline p-dichlorobenzenes, 6:22409
**Recoils**
Reactions of recoil $^{38}Cl$ in crystalline p-dichlorobenzenes, 6:22409
**CHLORINE IONS**
**Energy-Level Transitions**
Recent results in $\Delta n = 0$, $n = 2$ transitions of helium-like systems, 6:22765 (ANL—80-126)
**Lamb Shift**
Precision determinations of high Z hydrogenic ion Lamb shifts, 6:22761 (ANL—80-126)
**CHLOROPHYLL**
**Electronic Structure**
Electronic structural properties and photosynthesis, 6:21810
**Structural Chemical Analysis**
Electronic structural properties and photosynthesis, 6:21810
**CHLOROPLASTS**
**Biochemical Reaction Kinetics**
Mass spectrometric determination of hydroxylamine photooxidation by illuminated chloroplasts, 6:22666
**CHROMIUM**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**CHROMIUM CARBIDES**
**Mechanical Properties**
Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers, 6:22029
**Phase Studies**
Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers, 6:22029
**CHROMIUM COMPLEXES**
**Chemical Preparation**
Organochromium(III) complexes derived from nitriles, 6:22388
**Chemical Reactions**
Organochromium(III) complexes derived from nitriles, 6:22388
**CHROMIUM COMPOUNDS**
**Auger Effect**
Analysis of transition metal carbonyl Auger line shapes, 6:22322
**CHROMIUM OXIDES**
**Auger Electron Spectroscopy**
Enhanced interdiffusion of Cu into rf-sputtered chromium oxide films, 6:22286
**Diffusion**
Enhanced interdiffusion of Cu into rf-sputtered chromium oxide films, 6:22286
**Sputtering**
Enhanced interdiffusion of Cu into rf-sputtered chromium oxide films, 6:22286
**CHROMIUM SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581
**CHROMODYNAMICS**
*See QUANTUM CHROMODYNAMICS*
**CHROMOSOMES**
**Biological Radiation Effects**
Effect of cytosine arabinoside on the frequency of x-ray-induced chromosome aberrations in normal human leukocytes, 6:22699
**CHRYSENE**
**Liquid Column Chromatography**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**Mass Spectroscopy**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**CIRCADIAN VARIATIONS**
*See DAILY VARIATIONS*
**CLASSICAL MECHANICS**
**Hamiltonians**
Constraint dynamics of particle world lines, 6:22870
**Poincare Groups**
Constraint dynamics of particle world lines, 6:22870
**CLAYS**
**Mineralogy**
Clay mineralogy of selected sediments and soils at the Savannah River Plant, Aiken, South Carolina, 6:22729 (DP-MS—80-119)
**CLINCH RIVER BREEDER REACTOR**
**Primary Coolant Circuits**
Implications of stress range for inelastic analysis (CRBRP flued head containment penetration), 6:22033 (CONF-810625—14)
**Reactor Cooling Systems**
Simplified inelastic analysis procedure to evaluate a butt-welded elbow end, 6:22034 (CONF-810625—16)
**Steam Generators**
Status of the CRBRP steam-generator design, 6:22031 (CONF-810615—2)
**CLINTON P ANDERSON MESON PHY. FACILITY**
*See LAMPF LINAC*
**CLOSTRIDIUM**
**Growth**
Novel approach to the growth of anaerobic microorganisms, 6:22648 (CONF-810554—1)
**CO2 FLOODING**
*See CARBON DIOXIDE INJECTION*
**COAL**
*See also BITUMINOUS COAL*
*LIGNITE*
*SOLVENT-REFINED COAL*
*SUBBITUMINOUS COAL*
**Chemical Analysis**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
**Chemical Bonds**
Quantitation of the reductive cleavage of aryl ethers of SRC and coals. Semi Annual report, September 1980-March 1981, 6:21507 (DOE/PC/30227—T1)
**Chemical Reaction Kinetics**
Rockwell international gasifier--flash hydropyrolysis, 6:21523
**Combustion**
Coal Combustion Systems Division (Report section), 6:22461 (EPRI-P—1726-SR)
Effects of preignition on pulverized-coal combustion. Second quarterly report, 1 January 1981-31 March 1981 (Above 800K), 6:21562 (DOE/PC/30293—2)
Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation, 6:21487 (DOE/FC/10066—T1-(Vol.3))
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, July 1-September 30, 1979, 6:21558 (DOE/CS/40037—T1)
Regional and national NO/sub x/ emissions, 6:22537 (ANL/EES-TM—130)
**Combustion Kinetics**
Coal combustion studies. Task 4a, 6:21560 (DOE/ET/15518—3)

**Demonstration Programs**
Low-rank coal study. Volume 5. RD and D program evaluation, 6:21488 (DOE/FC/10066—T1(Vol.5))
**Energy Demand**
Demand for world coal through 1995 (US DOE; forecasting to 1995; global aspects), 6:21564
**Environmental Impacts**
Simple models and the comparison of monitoring rules related to National Ambient Air Quality Standards, 6:22539 (CONF-801045—)
**Fluidized-Bed Combustion**
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)
Multi-stage desulfurizing fluid-bed combustor for coal-fired hot gas generator systems: Topical report No. 3. Task 6. Modifications to Materials Handling Equipment. Task 7. Testing, 6:22459 (DOE/ET/10484—T2)
Rivesville multicell fluidized-bed boiler. Annual technical progress report, July 1979-June 1980, 6:22460 (DOE/MC/16230—154)
**Fuel Consumption**
Demand for world coal through 1995 (US DOE; forecasting to 1995; global aspects), 6:21564
**Hydrogenation**
Studies of the mechanism of coal hydrogenation by electron spin resonance. Quarterly technical progress report No. 4, 1 September 1980-31 November 1980, 6:21503 (DOE/PC/30072—T3)
**Marketing**
Coal management symposium: coal conference and EXPO V, 6:21566
**Regulations**
Regulating coal: new approaches for a Reagan administration (From 1980 Mineral Economics Symposium), 6:22124
**Research Programs**
Low-rank coal study. Volume 5. RD and D program evaluation, 6:21488 (DOE/FC/10066—T1(Vol.5))
Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation, 6:21487 (DOE/FC/10066—T1-(Vol.3))
**Resource Conservation**
Air quality analysis of Phase I of the proposed oil backout legislation: Introduction, 6:22229 (ANL/EES-TM—130)
**Scanning Electron Microscopy**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
**Trade**
Demand for world coal through 1995 (US DOE; forecasting to 1995; global aspects), 6:21564
**X-Ray Spectroscopy**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)

**COAL DEPOSITS**
**Exploration**
Geophysical examination of coal deposits, 6:21545 (ICTIS/TR—13)
**Geology**
Low-rank coal study : national needs for resource development. Volume 2. Resource characterization, 6:21543 (DOE/FC/10066—T1(Vol.2))

**COAL GASIFICATION**
*See also EXXON GASIFICATION PROCESS*
*FLASH HYDROPYROLYSIS PROCESS*
*HYGAS PROCESS*
*IN-SITU GASIFICATION*
*KOPPERS-TOTZEK PROCESS*
*LURGI PROCESS*
*LURGI SLAGGING PROCESS*
*SYNTHANE PROCESS*
*U-GAS PROCESS*
*WESTINGHOUSE GASIFICATION PROCESS*
*WINKLER PROCESS*
DOE program for the development of a peat utilization technology, 6:21528
**Demonstration Plants**
Gasifiers in industry: experiences on the first few projects., 6:21530
**Feasibility Studies**
High mass flux gasifier, 6:21533
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report (Appendices of T1; nearly all data and tables; see T1 for abstract), 6:21509 (DOE/RA/20222—T2)
**Fluidized-Bed Combustors**
Multi-stage desulfurizing fluid-bed combustor for coal-fired hot gas generator systems: Topical report No. 3. Task 6. Modifications to Materials Handling Equipment. Task 7. Testing, 6:22459 (DOE/ET/10484—T2)
**Permit Applications**
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))
**Technology Assessment**
Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation, 6:21487 (DOE/FC/10066—T1-(Vol.3))

**COAL GASIFICATION PLANTS**
**Construction**
Manpower requirements for an emerging energy technology: high-Btu coal gasification, 6:21510 (DOE/TIC—1021172)
**Design**
CS/R Advanced Peat Hydrogasification Process, 6:21519
Pipeline Gas Demonstration Plant. Phase I. Annual technical progress report, July 1, 1979-June 30, 1980, 6:21495 (DOE/ET/13060—T2)
Synopsis of interim final report. conceptual design of a coal-to-methanol commercial plant, 6:21733
**Economics**
CS/R Advanced Peat Hydrogasification Process, 6:21519
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)
**Employment**
Construction-employment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities, 6:22100 (ANL/CNSV—19)
**Engineering**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
**Licenses**
Pipeline Gas Demonstration Plant. Phase I. Annual technical progress report, July 1, 1979-June 30, 1980, 6:21495 (DOE/ET/13060—T2)
**Manpower**
Manpower requirements for an emerging energy technology: high-Btu coal gasification, 6:21510 (DOE/TIC—1021172)
**Materials**
AR and TD fossil-energy-materials program. Quarterly progress report, October-December 1980, 6:21513 (ORNL/FMP—81/1)
**Materials Testing**
Overview of coal-gasification-materials experience in selected pilot plants, 6:21489 (CONF-810417—6)
**Permit Applications**
Pipeline Gas Demonstration Plant. Phase I. Annual technical progress report, July 1, 1979-June 30, 1980, 6:21495 (DOE/ET/13060—T2)
**Site Selection**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)
**Solid Wastes**
Coal conversion solid wastes: characterization for environmental assessment, 6:21515 (ORNL/TM—7533)

**COAL INDUSTRY**
**Management**
Coal management symposium: coal conference and EXPO V, 6:21566
**Research Programs**
Coal management symposium: coal conference and EXPO V, 6:21566

**COAL LIQUEFACTION**
*See also EXXON LIQUEFACTION PROCESS*
*FLASH HYDROPYROLYSIS PROCESS*
*H-COAL PROCESS*
*SRC-II PROCESS*
**Catalysts**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, December 1, 1979-February 29, 1980, 6:21500 (DOE/ET/14806—T3)
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)
**Energy Recovery**
Energy recovery in coal conversion, 6:21491 (CONF-8003114—)
**Process Development Units**
Safety analysis of the 1000 lb/day coal-liquefaction PDU, 6:21505 (DOE/PC/30198—T5)
**Risk Assessment**
Safety analysis of the 1000 lb/day coal-liquefaction PDU, 6:21505 (DOE/PC/30198—T5)
**Technology Assessment**
Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation, 6:21487 (DOE/FC/10066—T1-(Vol.3))

**COAL LIQUEFACTION PLANTS**
**Economic Impact**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Employment**
Construction-employment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities, 6:22100 (ANL/CNSV—19)
**Materials**
AR and TD fossil-energy-materials program. Quarterly progress report, October-December 1980, 6:21513 (ORNL/FMP—81/1)
**Residues**
Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979, 6:21538 (DOE/MC/08004—T8)
**Site Selection**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Social Impact**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Valves**
Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report, 6:21497 (DOE/ET/13537—T3)

**COAL LIQUIDS**
**Chemical Analysis**
Conversion of solvent refined lignite into premium liquid fuels. Annual report, January-December, 1980, 6:21502 (DOE/FC/02101—T1)
Determination of sulfur heterocycles in coal liquids and shale oils, 6:21537
**Chemical Composition**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
**Denitrification**
Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980, 6:21494 (DOE/ET/11429—T1)
**Distillation**
Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, January-March 1981, 6:21493 (DOE/ET/10532—T1)
**Fractionation**
Comparison of chemical and mutagenic properties of a coal liquid and a shale oil, 6:21516 (PNL-SA—8812)
Conversion of solvent refined lignite into premium liquid fuels. Annual report, January-December, 1980, 6:21502 (DOE/FC/02101—T1)
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
**Health Hazards**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
**Hydrogenation**
Conversion of solvent refined lignite into premium liquid fuels. Annual report, January-December, 1980, 6:21502 (DOE/FC/02101—T1)
Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980, 6:21494 (DOE/ET/11429—T1)
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, January-March 1981, 6:21493 (DOE/ET/10532—T1)
**Marketing Research**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
**Mutagen Screening**
Comparison of chemical and mutagenic properties of a coal liquid and a shale oil, 6:21516 (PNL-SA—8812)
**Performance Testing**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
**Stability**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
**Uses**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)

**COAL MINES**
**Construction**
Manpower requirements for an emerging energy technology: high-Btu coal gasification, 6:21510 (DOE/TIC—1021172)
**Manpower**
Manpower requirements for an emerging energy technology: high-Btu coal gasification, 6:21510 (DOE/TIC—1021172)

**COAL MINING**
*See also LONGWALL MINING*
*SURFACE MINING*

*UNDERGROUND MINING*
**Environmental Impact Statements**
Final environmental impact statement. Alabama Electric Cooperative, purchase of coal property leases, 6:22606
**Technology Assessment**
Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation, 6:21487 (DOE/FC/10066—T1-(Vol.3))

**COAL PREPARATION**
**Jigs**
Investigation of coal preparation processes in the circulating stream of water subjected to pulsation, 6:21557 (DOE/TIC—1018563)
**Technology Assessment**
Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation, 6:21487 (DOE/FC/10066—T1-(Vol.3))

**COAL-DERIVED LIQUIDS**
*See COAL LIQUIDS*

**COAL-FIRED MHD GENERATORS**
**Combustors**
Coal combustion studies. Task 4a, 6:21560 (DOE/ET/15518—3)

**COASTAL REGIONS**
**Carbon Cycle**
Fate of terrestrial organic carbon in the coastal area, 6:22570 (CONF-8009140—)

**COATINGS**
*See also REFLECTIVE COATINGS*
Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers, 6:22029
**Corrosion Resistance**
Evaluation of alloys for fuel cell heat exchangers. Final report (Texaco entrained gasifier), 6:21511 (EPRI-EM—1815)
**Deposition**
Final report on research on optical coatings, 6:22305 (DOE/DP/40094—T1)
**Isotope Dating**
Desert varnish: potential for age dating via uranium-series isotopes, 6:22727
**Physical Properties**
Boron coatings on graphite for fusion reactor applications, 6:22959
**Physical Radiation Effects**
Deuterium and helium ion irradiation effects on $TiB_2$ coatings, 6:22960
**Sulfidation**
Evaluation of alloys for fuel cell heat exchangers. Final report (Texaco entrained gasifier), 6:21511 (EPRI-EM—1815)

**COBALT**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Photon Transport**
Anomalous scattering of X-rays by cesium and cobalt measured with synchrotron radiation, 6:22857

**COBALT 59 TARGET**
**Electron Reactions**
Exchange current effects in magnetic electron scattering from $^{49}$Ti, $^{51}$V, $^{59}$Co, $^{87}$Sr, and $^{93}$Nb, 6:22850

**COBALT ALLOYS**
**Electrodeposition**
Galvanic deposition of superinvar alloys, 6:22293 (UCRL-Trans—11676)

**COBALT SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581

**COCKCROFT-WALTON ACCELERATORS**
**Performance Testing**
New, rugged, high power Cockcroft-Walton power supply, 6:22489 (LBL—11715)

**CO-GENERATION**
*See COGENERATION*

**COGENERATION**
**Economic Analysis**
Co-generation, 6:22236 (CONF-8003114—)
**Environmental Effects**
Environmental trade-offs with the adoption of cogeneration technologies, 6:22109
**Feasibility Studies**
Thin film battery/fuel cell power generation system. Topical report covering Task 5: the design, cost and benefit of an industrial cogeneration system, using a high-temperature solid-oxide-electrolyte (HTSOE) fuel-cell generator, 6:22159 (DOE/ET/11305—T8)
**Meetings**
Energy generation & cogeneration from wood, 6:21734

**COGENERATION PLANTS**
**Data Compilation**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Employment**
Construction-employment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities, 6:22100 (ANL/CNSV—19)
**Refuse-Fueled Boilers**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Reviews**
Local government guide to the emerging technologies of cogeneration and photovoltaics. Energy technology report of the energy task force of the urban consortium, 6:21821 (DOE/IR/05106—T24)
**Surveys**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)

**COINCIDENCE SPECTROMETRY**
Method for determining the neutron multiplicity for gamma rays from (particle,xnγ) reactions (n-γ coincidence), 6:22845

**COKE OVENS**
**On-Line Control Systems**
Mathematical modeling and control of the coke making process, 6:21490 (CONF-810473—1)

**COKING**
**Mathematical Models**
Mathematical modeling and control of the coke making process, 6:21490 (CONF-810473—1)

**COLD PLASMA**
Some aspects of the study of gas-discharge plasma and production of high magnetic fields (Book), 6:22152 (DOE-tr—73)

**COLD STORAGE**
Longterm storage of coolness (In cisterns), 6:21953

**COLEOPTILE**
**Pressure Gradients**
Osmoregulation in the Avena coleoptile in relation to auxin and growth, 6:22662

**COLLIERIES**
*See COAL MINES*

**COLLISIONLESS PLASMA**
**Cyclotron Instability**
Numerical simulations of electrostatic hydrogen cyclotron instabilities, 6:22890
**Electron Drift**
Numerical simulations of electrostatic hydrogen cyclotron instabilities, 6:22890

**COLOR**
**Display Devices**
Raster color displays: examples, ideas, and principles, 6:22225 (CONF-801045—)
**Uses**
Raster color displays: examples, ideas, and principles, 6:22225 (CONF-801045—)

**COLORADO**
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Scottsbluff NTMS Quadrangle, Nebraska and Colorado, 6:21641 (GJBX—145(81))

**Magnetic Surveys**
Aerial radiometric and magnetic survey: Grand Junction National Topographic map, Colorado, Utah. Final report, 6:21627 (GJBX—112(81))
**Radiometric Surveys**
Aerial radiometric and magnetic survey: Grand Junction National Topographic map, Colorado, Utah. Final report, 6:21627 (GJBX—112(81))

**COLUMBIUM**
*See NIOBIUM*

**COMBINED COLLECTORS**
Hybrid photovoltaic/thermal systems with a solar-assisted heat pump, 6:21826
**Design**
Flat plate combined photovoltaic/thermal energy system, 6:21827
Liquid photovoltaic/thermal collectors for residential applications, 6:21940 (DOE/ET/20279—137)
**Performance**
Liquid photovoltaic/thermal collectors for residential applications, 6:21940 (DOE/ET/20279—137)

**COMBINED-CYCLE POWER PLANTS**
Westinghouse coal gasification system, 6:21532
**Central Receivers**
Preliminary heat pipe testing program. Final technical report, 6:21838 (DOE/SF/10756—1)
**Combustors**
Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)
**Comparative Evaluations**
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**Design**
Development of high-temperature turbine subsystem technology to a technology readiness status, Phase II. Quarterly report, January-March 1981, 6:21995 (DOE/ET/10340—T4)
**Economic Analysis**
High-temperature turbine technology program. Turbine subsystem design report: Low-Btu gas, 6:21994 (DOE/ET/10340—T3)
**Environmental Impacts**
High-temperature turbine technology program. Turbine subsystem design report: Low-Btu gas, 6:21994 (DOE/ET/10340—T3)
**Gas Turbines**
Development of high-temperature turbine subsystem technology to a technology readiness status, Phase II. Quarterly report, January-March 1981, 6:21995 (DOE/ET/10340—T4)
High-temperature turbine technology program. Turbine subsystem design report: Low-Btu gas, 6:21994 (DOE/ET/10340—T3)
High-temperature-turbine technology program. Phase II. Technology test and support studies. Technical progress report, April 1, 1979-June 30, 1979, 6:21996 (DOE/ET/10348—T2)
**Liquid Fuels**
Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)
**Performance**
Performance calculations for 200-1000 MWe MHD/steam power plants, 6:22151 (DOE/NASA/10769—16)
**Technology Assessment**
Development of high-temperature turbine subsystem technology to a technology readiness status. Phase II. Quarterly report, January-March 1981, 6:21995 (DOE/ET/10340—T4)
**Test Facilities**
Gasification combined cycle test facility at Powerton, 6:21526
**Thermal Efficiency**
Gasification combined cycle test facility at Powerton, 6:21526

**COMBUSTION**
*See also FLUIDIZED-BED COMBUSTION*
*IN-SITU COMBUSTION*
**Research Programs**
Coal Combustion Systems Division (Report section), 6:22461 (EPRI-P—1726-SR)
**Test Facilities**
Safety analysis of the 700-horsepower combustion test facility, 6:21561 (DOE/PC/30198—T4)

**COMBUSTION CHAMBERS**
*See also COMBUSTORS*
**Sprays**
Experimental investigation into the application of spontaneous Raman scattering to spray measurements in an engine, 6:22259 (SAND—81-8642)

**COMBUSTION PRODUCTS**
**Carcinogenesis**
Tumorigenesis of diesel exhaust, gasoline exhaust, and related emission extracts on SENCAR mouse skin, 6:22702 (CONF-800323—4)
**Corrosive Effects**
Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)

**COMBUSTORS**
**Design**
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, July 1-September 30, 1979, 6:21558 (DOE/CS/40037—T1)
Pulverized coal firing of aluminum melting furnaces. Quarterly technical progress report, October 1-December 31, 1979, 6:21559 (DOE/CS/40037—T2)
**Performance**
Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)
**Protective Coatings**
Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils, 6:21999 (DOE/ET/12292—T1)
**Technology Assessment**
Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)

**COMMERCIAL BUILDINGS**
**Daylighting**
Passive solar manufactured buildings for commercial applications, 6:21899
**Demonstration Programs**
Strategies for the use of passive solar approaches in commercial buildings, 6:21896
**Energy Analysis**
DOE-2 Verification Project. Phase I. Interim report, 6:22205 (LA—8295-MS)
**Energy Consumption**
DOE-2 Verification Project. Phase I. Interim report, 6:22205 (LA—8295-MS)
**Energy Efficiency Standards**
Phase-two report for the development of Energy-Performance Standards for new buildings. Final report, 6:22198 (DOE/TIC—11457)
**Passive Solar Cooling Systems**
Passive solar manufactured buildings for commercial applications, 6:21899
**Passive Solar Heating Systems**
Design of passive commercial buildings: major lessons learned, 6:21895
Passive solar manufactured buildings for commercial applications, 6:21899
**Solar Space Heating**
Performance comparison of solar space heating systems of selected active sites in the National Solar Data Network, 6:21867 (SOLAR/0005—81/80)
Wall collector design analysis: project status report No. 2. Hing/daylighting prototype development, Phase I, 6:21849 (DOE/CS/30367—4)

**COMMERCIAL SECTOR**
**Thermal Energy Storage Equipment**
Preliminary market analysis for customer side of the meter thermal-energy storage, 6:22193 (DOE/ET/26716—T1)
**COMMON MARKET**
**Imports**
Demand for world coal through 1995 (US DOE; forecasting to 1995; global aspects), 6:21564
**COMMUNITIES**
*See also PLANNED COMMUNITIES*
**Energy Audits**
Municipal energy conservation manual, 6:22252 (DOE/TIC—1021874)
**Energy Conservation**
Energy conservation manual: a guide for regional planning commission assistance to small municipalities, 6:22253 (DOE/TIC—1022897)
Guide to reducing energy use...budget costs. Volume II. Local energy management program, 6:22248 (DOE/CS/60419—T1)
**Energy Management**
Municipal Energy Management Program (MEMP), 6:22118
**COMPLIANCE**
**Cost Benefit Analysis**
Assessment of the proposed legislation, 6:22553 (ANL/EES-TM—130)
**COMPOUND PARABOLIC CONCENTRATORS**
**Solar Flux**
Geometrical vector flux sinks and ideal flux concentrators, 6:21950
**COMPOUNDS (ORGANIC)**
*See ORGANIC COMPOUNDS*
**COMPUTER CODES**
**C Codes**
Cell string model with mirror gap shading for a parabolic-trough photovoltaic collector, 6:21775 (SAND—81-0069)
**D Codes**
DOE-2 Verification Project. Phase I. Interim report, 6:22205 (LA—8295-MS)
**L Codes**
Input parameters for LEAP and analysis of the Model 22C data base, 6:22120 (ORNL—5746)
Operating experience with LEAP from the perspective of the computing applications analyst, 6:22099 (ORNL/CSD/TM—141)
**M Codes**
MAZE: an input generator for DYNA2D and NIKE2D, 6:22265 (UCID—19029)
SOLPAS: passive solar algorithms. User's manual, 6:21863 (MCR—81-543)
**Optimization**
Application of software engineering to development of reactor-safety codes, 6:22077 (HEDL-SA—2244-FP)
Application of software to development of reactor-safety codes, 6:22078 (HEDL-SA—2244-S)
**P Codes**
Materials measurement and accounting in an operating plutonium conversion and purification process. Phase I. Process modeling and simulation (PUCSF code), 6:21694 (LA—8809-MS)
Modeling the environmental fate of synthetic organic chemicals, 6:22590
**R Codes**
Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers (REAMPA code), 6:22786 (LBL—12626)
**S Codes**
Cooling-and-heating-load improvements in seasonal-performance modeling of room and central air conditioners and heat pumps, 6:22213 (SAI—444-80-299-LJ)
SOLPAS: passive solar algorithms. User's manual, 6:21863 (MCR—81-543)
**V Codes**
Distillate price-monitoring system. Final report (Kerosene No. 1 and No. 2 home heating oil), 6:21583 (DOE/EIA/06278—T1)
VEPEC: a 3D vector potential equilibrium code for high-beta minimum-B plasma confinement, 6:22888 (UCRL—53099)
**Validation**
DOE-2 Verification Project. Phase I. Interim report, 6:22205 (LA—8295-MS)
**COMPUTER GRAPHICS**
**Interfaces**
PLOT2K: a graphics interface to System 2000, 6:22975 (LA-UR—81-1192)
**COMPUTER LANGUAGES**
*See PROGRAMMING LANGUAGES*
**COMPUTER NETWORKS**
**Switching Circuits**
SNLA terminal switching network, 6:22976 (SAND—81-0691C)
**COMPUTER OUTPUT DEVICES**
**Cost**
Computer-aided design drafting/manufacturing (CADD/M) facility preparation, 6:22982 (UCRL—84964)
Selecting and implementing an interactive Computer Aided Design Drafting/Manufacturing (CADD/M) system, 6:22983 (UCRL—84965)
**Installation**
Computer-aided design drafting/manufacturing (CADD/M) facility preparation, 6:22982 (UCRL—84964)
**Maintenance**
Computer-aided design drafting/manufacturing (CADD/M) facility preparation, 6:22982 (UCRL—84964)
**Operation**
Computer-aided design drafting/manufacturing (CADD/M) facility preparation, 6:22982 (UCRL—84964)
Selecting and implementing an interactive Computer Aided Design Drafting/Manufacturing (CADD/M) system, 6:22983 (UCRL—84965)
**COMPUTER-AIDED DESIGN**
**Economic Analysis**
Cost justification for an interactive Computer-Aided Design Drafting/Manufacturing system, 6:22984 (UCRL—84966)
**Implementation**
Computer-aided design drafting/manufacturing (CADD/M) facility preparation, 6:22982 (UCRL—84964)
Selecting and implementing an interactive Computer Aided Design Drafting/Manufacturing (CADD/M) system, 6:22983 (UCRL—84965)
**Meetings**
DOE workshop on design automation and computer-aided design: abstracts, 6:22978 (UCID—18649)
**COMPUTERS**
*See also UNIVAC COMPUTERS*
**Secrecy Protection**
Local design specifications for the CCN security controller (SC), 6:22977 (SAND—81-0994)
**Security**
Local design specifications for the CCN security controller (SC), 6:22977 (SAND—81-0994)
**CONCANAVALIN**
**Biological Effects**
Cell surface modulation of gene expression in brain cells by down regulation of glucocorticoid receptors, 6:22617
**CONCENTRATING COLLECTORS**
**Marketing Research**
Solar-collector studies for solar-heating and -cooling applications. Final report, 6:21939 (DOE/CS/35349—T1)
**Performance**
Solar-collector studies for solar-heating and -cooling applications. Final report, 6:21939 (DOE/CS/35349—T1)
**CONCENTRATOR SOLAR CELLS**
**Design**
Low-cost, actively-cooled linear photovoltaic receiver, 6:21780 (SAND—81-7113C)
**Economic Analysis**
Overview: recent developments and potential of photovoltaic concentrating collectors, 6:21779 (SAND—81-1222C)
**Efficiency**
Compatibility of Fresnel lenses and photovoltaic cells in concentrator modules, 6:21777 (SAND—81-1191C)

**Fresnel Lens**
Compatibility of Fresnel lenses and photovoltaic cells in concentrator modules, 6:21777 (SAND—81-1191C)
**Performance**
Application potentials for flat plate and concentrator photovoltaic collectors, 6:21834
**Performance Testing**
Low-cost, actively-cooled linear photovoltaic receiver, 6:21780 (SAND—81-7113C)
Real-time performance testing of photovoltaic-concentrator modules, 6:21776 (SAND—81-1145C)
**Reviews**
Photovoltaic concentrator development, 6:21829
**Solar Concentrators**
Photovoltaic concentrator development, 6:21829
**Solar Receivers**
Low-cost, actively-cooled linear photovoltaic receiver, 6:21780 (SAND—81-7113C)
**Technology Assessment**
Overview: recent developments and potential of photovoltaic concentrating collectors, 6:21779 (SAND—81-1222C)
Photovoltaic concentrator technology, 6:21778 (SAND—81-1211C)
**Uses**
Application potentials for flat plate and concentrator photovoltaic collectors, 6:21834
**CONCRETE-PLASTIC COMPOSITES**
**Curing**
Catalytic effect of a Portland cement filler on the cure of water-compatible resorcinol phenol-formaldehyde polymer concrete, 6:22307
**CONCRETES**
**Materials Testing**
Survey of concrete waste forms, 6:21659 (CONF-8005107—)
**Research Programs**
Survey of concrete waste forms, 6:21659 (CONF-8005107—)
**CONDENSATES**
**Waste Water**
Wastewater treatment in the oil-shale industry, 6:21615 (LBL—11214)
**CONDENSED AROMATICS**
*See also BENZOPYRENE*
*CHRYSENE*
*TRIPHENYLENE*
**Mass Spectroscopy**
Hydrocarbon type analysis of jet fuels by $^{1}H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)
**NMR Spectra**
Hydrocarbon type analysis of jet fuels by $^{1}H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)
**CONFIGURATION INTERACTION**
**Comparative Evaluations**
Formal and numerical convergence comparison of SCI and exponential methods, 6:22785 (LBL—12157)
**Iterative Methods**
MCSCF optimization through iterative CI calculations in the single excitation space and MCSCF wave functions in the full reaction space, 6:22781 (LBL—12157)
**Meetings**
Recent developments and applications of multi-configuration Hartree-Fock methods. NRCC proceedings No. 10, 6:22777 (LBL—12157)
**Wave Functions**
Recent developments in multiconfiguration wavefunction optimization, 6:22784 (LBL—12157)
**CONNECTICUT**
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Heating Oils**
State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980, 6:21586 (DOE/EIA/10221—T2)
**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Kerosene**
State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980, 6:21586 (DOE/EIA/10221—T2)
**CONOCO GASIFICATION PROCESS**
**Demonstration Plants**
Demonstration plant process design. Phase I. The Pipeline Gas Demonstration Plant. Volume 1. Executive summary., 6:21535 (DOE/ET/13060—T1)
**Site Selection**
Demonstration plant process design. Phase I. The Pipeline Gas Demonstration Plant. Volume 1. Executive summary., 6:21535 (DOE/ET/13060—T1)
**CONSERVATION (ENERGY)**
*See ENERGY CONSERVATION*
**CONSERVATION (RESOURCE)**
*See RESOURCE CONSERVATION*
**CONSTRUCTION INDUSTRY**
**Employment**
Construction-employment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities, 6:22100 (ANL/CNSV—19)
**Energy Consumption**
Handbook of energy use for building construction, 6:22190 (DOE/CE/20220—1)
**CONTAINMENT BUILDINGS**
**Research Programs**
Structural mechanics, 6:22052 (LA—8797-PR)
**Stress Analysis**
Structural mechanics, 6:22052 (LA—8797-PR)
**CONTAINMENT SYSTEMS**
**Ice Condensers**
Some hydrogen-control considerations for ice-condenser nuclear plants (PWR), 6:22082 (UCRL—15345)
**CONTINENTAL SHELF**
**Natural Gas Deposits**
United States Depratment of the Interior final environmental impact statement, 6:21590
**Petroleum Deposits**
United States Depratment of the Interior final environmental impact statement, 6:21590
**CONTRACTS**
**Audits**
Office of the Inspector General. Annual report, 6:22967 (DOE/IG—0008/1)
**CONTROL SYSTEMS**
*(For automated processes including feedback.)*
**Meetings**
Automotive electronics, 6:22263
**CONVEYORS**
**Research Programs**
The US Department of Energy's coal mining research, 6:21554
**COOLERS**
*See HEAT EXCHANGERS*
**COOLING LOAD**
**Calculation Methods**
Cooling-and-heating-load improvements in seasonal-performance modeling of room and central air conditioners and heat pumps, 6:22213 (SAI—444-80-299-LJ)
**COOLING SYSTEM (REACTOR)**
*See REACTOR COOLING SYSTEMS*
**COOLING SYSTEMS**
*See also PASSIVE SOLAR COOLING SYSTEMS*
*REACTOR COOLING SYSTEMS*
*SOLAR COOLING SYSTEMS*
**Economic Analysis**
Optimizing power plant coolant systems, 6:21993 (CONF-8003114—)
**Energy Consumption**
Energy conservation case study, 9409-13 cooling tower: 9201-5 chiller system, 6:22175 (CONF-8003114—)
**Environmental Impacts**
Section 316(b) and modeling of ichthyoplankton entrainment, 6:22007 (CONF-810545—2)

**Information**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
**Operation**
Energy conservation case study, 9409-13 cooling tower: 9201-5 chiller system, 6:22175 (CONF-8003114—)
**Optimization**
Optimizing power plant coolant systems, 6:21993 (CONF-8003114—)

**COPOLYMERS**
**Chemical Preparation**
Water-soluble copolymers. I. Synthesis of model dextran-g-polyacrylamides by Fe(II)/$H_2O_2$ initiation and characterization by aqueous size exclusion chromatography (For use as viscosity modifiers for enhanced oil recovery), 6:21574
**Molecular Weight**
Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310
**Shear**
Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310
**Synthesis**
Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310
**Viscosity**
Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310

**COPPER**
Material selection for TFTR limiters, 6:22921
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Chemisorption**
Thermal desorption and UPS study of CO adsorbed on Cu-covered Ru (0001), 6:22289
**Degassing**
Gas release studies from explosion-cladded materials, 6:22922
**Desorption**
Thermal desorption and UPS study of CO adsorbed on Cu-covered Ru (0001), 6:22289
**Diffusion**
Enhanced interdiffusion of Cu into rf-sputtered chromium oxide films, 6:22286
**Electronic Structure**
Thermal desorption and UPS study of CO adsorbed on Cu-covered Ru (0001), 6:22289
**Frenkel Defects**
Defect clustering in copper, silver and aluminium during heavy-ion irradiations at low temperatures (AR or Kr ions, or 150 kev protons), 6:22272
**X-Ray Spectra**
Extended x-ray absorption fine structure of copper in cytochrome c oxidase: direct evidence for copper-sulfur ligation, 6:22390

**COPPER ALLOYS**
**Electronic Structure**
Surface segregation and surface electronic structure of PtCu alloys: Dependence on atomic coordination, 6:22288
**Photoelectron Spectroscopy**
Surface segregation and surface electronic structure of PtCu alloys: Dependence on atomic coordination, 6:22288

**COPPER CHLORIDES**
**Crystal-Phase Transformations**
Solid-state phase transitions in CuCl under hydrostatic pressures to 12.8 GPa, 6:22312 (LA-UR—81-1443)

**COPPER COMPOUNDS**
**Exchange Interactions**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319
**Magnetic Susceptibility**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319
**Neutron Diffraction**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319
**Spin Waves**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319

**COPPER IONS**
**Energy Levels**
Energy levels of highly ionized atoms, 6:22762 (ANL—80-126)
**Ultraviolet Spectra**
Energy levels of highly ionized atoms, 6:22762 (ANL—80-126)

**COPPER OXIDES**
**Electrical Properties**
Investigation of solar cells based on $Cu_2O$. Progress report, June 1, 1980-November 30, 1980, 6:21786 (SERI/PR—9190-1-T1)
**Microstructure**
Investigation of solar cells based on $Cu_2O$. Progress report, June 1, 1980-November 30, 1980, 6:21786 (SERI/PR—9190-1-T1)

**CORN (MAIZE)**
*See MAIZE*

**CORN STOVER**
*See AGRICULTURAL WASTES*

**CORONA (SOLAR)**
*See SOLAR CORONA*

**CORTEX (ADRENAL)**
*See ADRENAL GLANDS*

**COSMIC NEUTRINOS**
**Spin**
Magnetic moment of massive neutrinos and the cosmic helium abundances, 6:22826

**COSMIC NUCLEI**
**Abundance**
Magnetic moment of massive neutrinos and the cosmic helium abundances, 6:22826

**COSMIC PARTICLES**
*See COSMIC RADIATION*

**COSMIC RADIATION**
**Chemical Composition**
Anomalous isotoptic composition of cosmic rays, 6:22741
**Origin**
Galactic origin of cosmic rays II, 6:22740 (LA-UR—81-966)
Galactic origin of cosmic rays I, 6:22739 (LA-UR—81-965)

**COST**
*See also LIFE-CYCLE COST*
**Allocations**
Analysis of fully distributed cost pricing in regulated industries, 6:22102

**COUNTERS (RADIATION)**
*See RADIATION DETECTORS*

**COUNTY BUILDINGS**
*See PUBLIC BUILDINGS*

**COURT BUILDINGS**
*See PUBLIC BUILDINGS*

**CRABS**
*See CRUSTACEANS*

**CRACKS**
**Mathematical Models**
Explosively produced fracture of oil shale, July-September 1979, 6:21607 (LA—8397-PR)

**CRBR REACTOR**
*See CLINCH RIVER BREEDER REACTOR*

**CREEKS**
*See RIVERS*

**CRESOLS**
**Enthalpy**
Enthalpy measurement of coal-derived liquids. Final technical progress report (200 to 740°F and 200 to 1500 psia), 6:21496 (DOE/ET/13395—T1)

**Liquid Column Chromatography**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**Mass Spectroscopy**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**CRESYLIC ACID**
*See CRESOLS*
**CRG PROCESSES**
**Performance Testing**
Gasification of caking coals in the BGC/Lurgi slagging gasifier--a status report., 6:21534
**CRITICAL ASSEMBLIES**
*See ZERO POWER REACTORS*
**CRITICALITY**
**Personnel Dosimetry**
Nuclear accident dosimetry: Los Alamos measurements at the seventeenth nuclear accident dosimetry intercomparison study at the Oak Ridge National Lab., DOSAR Facility, August 1980, 6:22860 (LA—8799-MS)
**CRITICALITY ACCIDENTS**
*See RADIATION ACCIDENTS*
**CROPS**
**Irrigation**
Agriculture, greenhouse, wetland and other beneficial uses of geothermal fluids and heat, 6:21976 (CONF-810471—1)
**Solar Drying**
Performance of an experimental annual cycle solar regenerated desiccant crop dryer, 6:21880
**CRUCIBLES**
**Fabrication**
Fabricating tungsten crucibles by drawing and extrusion spinning, 6:22277 (RFP—3049)
**CRUDE OIL**
*See PETROLEUM*
**CRUSTACEANS**
**Genetic Variability**
Evidence for nonrandom alterations in a fraction of the highly repetitive DNA of a eukaryote, 6:22639
**CRYOPUMPS**
**Design**
Large scale cryopumps for fusion power systems, 6:22953
TSTA compound cryopump, 6:22931
**Neutral Atom Beam Injection**
Doublet III neutral beam cryopumping system, 6:22932
**Performance**
Performance of BNL-TSTA compound cryopump, 6:22452
**Testing**
TSTA compound cryopump, 6:22931
**CRYSTAL LATTICES**
**Melting**
Melting of a two-dimensional electron lattice, 6:22862
**CRYSTALLINE LENS**
**Cell Membranes**
Unit membrane redundancy in spherical structures within the ocular lens (Rabbits), 6:22669
**Epithelium**
Control of cell proliferation in rabbit lens epithelium, 6:22636
**Scanning Electron Microscopy**
Energy dispersive x-ray analysis of human lens cataracts, 6:22647
**X-Ray Emission Analysis**
Energy dispersive x-ray analysis of human lens cataracts, 6:22647
**CRYSTALS**
**Electron Spin Resonance**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)
**Impurities**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)
**CULTURE MEDIA**
**Anaerobic Conditions**
Novel approach to the growth of anaerobic microorganisms, 6:22648 (CONF-810554—1)
**CULTURES (CELLS)**
*See CELL CULTURES*
**CURIUM 243**
**Electron Spin Resonance**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)
**CURIUM 244**
**Electron Spin Resonance**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)
**CURIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**CUTTING TOOLS**
**Power Demand**
Coal gettability studies: methods of evaluation and verification of coal deposited in seams, 6:21552 (DOE/TIC—1016824)
**CYCLONE SEPARATORS**
**Design**
Electrocyclone development program. Quarterly technical report, November 1980-January 1981, 6:22000 (DOE/ET/17091—T1)
**Operation**
Electrocyclone development program. Quarterly technical report, November 1980-January 1981, 6:22000 (DOE/ET/17091—T1)
**CYLINDRICAL PARABOLIC COLLECTORS**
*See PARABOLIC TROUGH COLLECTORS*
**CYTOCHROME OXIDASE**
**Bond Lengths**
Extended x-ray absorption fine structure of copper in cytochrome c oxidase: direct evidence for copper-sulfur ligation, 6:22390
**X-Ray Fluorescence Analysis**
Extended x-ray absorption fine structure of copper in cytochrome c oxidase: direct evidence for copper-sulfur ligation, 6:22390
**X-Ray Spectra**
Extended x-ray absorption fine structure of copper in cytochrome c oxidase: direct evidence for copper-sulfur ligation, 6:22390
**CYTOLOGY**
Analysis of cells isolated from bone cultured on collagen gels and polystyrene culture dishes, 6:22631 (UR—3490/LCP-22)
**CYTOSINE**
**Radiosensitivity Effects**
Effect of cytosine arabinoside on the frequency of x-ray-induced chromosome aberrations in normal human leukocytes, 6:22699
**CZOCHRALSKI METHOD**
**Equipment**
Development of advanced Czochralski growth process to produce low-cost 150-kg silicon ingots from a single crucible for technology readiness. First quarterly progress report, October 1, 1980-December 31, 1980, 6:21771 (DOE/JPL/955733—80/1)

## D

**DAILY VARIATIONS**
**Pattern Recognition**
n-dimensional pattern recognition in environmental systems, 6:22540 (CONF-801045—)
**DAIRY INDUSTRY**
**Giromill Turbines**
Wind driven direct water heating system development and field testing, 6:21989
**DARRIEUS ROTORS**
**Aerodynamics**
Recent Darrieus vertical-axis wind turbine aerodynamical experiments at Sandia National Laboratories, 6:21988 (SAND—81-1108C)

**Cables**
Guy-cable design and damping for vertical-axis wind turbines, 6:21986 (SAND—80-2669)
**Fasteners**
Guy-cable design and damping for vertical-axis wind turbines, 6:21986 (SAND—80-2669)
**Turbine Blades**
Accelerometer measurements of aerodynamic torque on the DOE/Sandia 17-m Vertical Axis Wind Turbine, 6:21987 (SAND—80-2776)
Recent Darrieus vertical-axis wind turbine aerodynamical experiments at Sandia National Laboratories, 6:21988 (SAND—81-1108C)
**DATA ACQUISITION**
Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)
**DATA ACQUISITION SYSTEMS**
**Design**
On-board data recorder for hard-target weapons, 6:22530 (UCRL—85730)
PDL-24 solar monitoring system, 6:21909
Reliability studies of materials using several LSI-11 based systems, 6:22448 (UCRL—85254)
**Specifications**
Multitest, DVM-based data acquisition system on an LSI-11/23, running under RSX-11M, 6:22985 (UCRL—85310)
**DATA ANALYSIS**
Analysis of large data sets project: computer science research areas, 6:22970 (CONF-791016—)
Help, where are we, 6:21618 (CONF-791016—)
Many facets of large (Large data sets), 6:22969 (CONF-791016—)
**DATA BASE MANAGEMENT**
**Information Retrieval**
Modelling summary data, 6:22990 (LBL—12350)
**DAYLIGHTING**
**Design**
Beamed daylighting: historical review, current testing and analysis and design options, 6:22214
Graphic daylighting design method: including clear sky conditions, 6:22216
**Testing**
Beamed daylighting: historical review, current testing and analysis and design options, 6:22214
**DC SYSTEMS**
*See also EHV DC SYSTEMS*
**Control Systems**
Robust control of multiterminal dc/ac systems, 6:22022
**Superconducting Cables**
Wave propagation in a dc superconducting cable--1. Analysis, 6:22014
**DECALSO**
*See ION EXCHANGE MATERIALS*
**DECANE**
**Phase Studies**
Displacement of oil by carbon dioxide. Final report, 6:21571 (DOE/ET/12082—9)
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576
**DEFORMED NUCLEI**
**Nuclear Alignment**
Particle angular momentum alignment effects in deformed nuclei, 6:22852
**DEGREE DAYS**
**Statistics**
Budget percentiles for baseline and redesigned commercial type buildings based on resource utilization factors (RUF) for cities with try weather tapes, 6:22200 (DOE/TIC—11461)
Budget percentiles for baseline and redesigned all commercial building types assuming no cooling, 6:22201 (DOE/TIC—11462)
Budget percentiles for baseline and redesigned: theaters, stores, shopping centers, storage, hi-rise apartments; low rise apartments, 6:22202 (DOE/TIC—11463)
Errata, nursing homes. Budget percentiles for baseline and redesigned commercial type buildings: cities with try weather tapes; based on resource utilization factors (RUF); based on price weighting factors (PWF), 6:22203 (DOE/TIC—11464)
Sampling variability for redesign buildings, 6:22199 (DOE/TIC—11460)
**DEHUMIDIFIERS**
**Design**
Design considerations for solar dehumidifiers, 6:21887
**DELAWARE**
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**DELAYED NEUTRON ANALYSIS**
**Measuring Instruments**
Monte Carlo calculational design of an NDA instrument for the assay of waste products from high enriched uranium spent fuels, 6:21690
**DEMAND FACTORS**
**Statistical Models**
Some factors influencing estimators in motor gasoline demand models, 6:22224 (CONF-801045—)
**DENATURATION (PROTEIN)**
*See PROTEIN DENATURATION*
**DENSITOMETERS**
Evaluation of an I/sub III/ x-ray absorption-edge densitometer for assay of mixed uranium-plutonium solutions, 6:22517
**Design**
Gamma ray NDA assay system for total plutonium and isotopics in plutonium product solutions, 6:21712
**DEOXYPENTOSE NUCLEIC ACID**
*See DNA*
**DEOXYRIBONUCLEIC ACID**
*See DNA*
**DESICCANTS**
**Solar Drying**
Corn drying with solar-dried desiccant, 6:21879
Design considerations for solar dehumidifiers, 6:21887
Performance of an experimental annual cycle solar regenerated desiccant crop dryer, 6:21880
**DESOXYRIBONUCLEIC ACID**
*See DNA*
**DESULFURIZATION**
**Catalysts**
Electronic structure of hydrodesulfurization catalysts, 6:21581
**DETECTORS (RADIATION)**
*See RADIATION DETECTORS*
**DETERGENTS**
**Biological Effects**
Anionic detergents as divalent cation ionophores across black lipid membranes, 6:22627
**DETONATION WAVES**
*See SHOCK WAVES*
**X-Ray Radiography**
PHERMEX applications to study high-pressure flow and detonation waves, 6:22524 (LA-UR—81-1270)
**DEUTERIUM**
**Chemical Reaction Kinetics**
Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)
**Chemisorption**
Hydrogen and deuterium sorption by selected rare earth intermetallic compounds at pressures up to 1500 atm, 6:22375
**Gettering**
Hydrogen isotope gettering with yttrium metal, 6:22374
**Isotope Effects**
Hydrogen and deuterium sorption by selected rare earth intermetallic compounds at pressures up to 1500 atm. 6:22375

Isotope effects in the lanthanum dihydrides, 6:22368
Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)
Temperature dependence of the luminescence lifetimes of halopentaammine- and hexaamminerhodium(III) compounds in the solid state, 6:22384

**Melting**
Theoretical calculation of thermodynamic properties and melting curves for hydrogen and deuterium, 6:22316

**Photochemical Reactions**
Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)

**Thermodynamic Properties**
Theoretical calculation of thermodynamic properties and melting curves for hydrogen and deuterium, 6:22316

**Trapping**
Deuterium trapping measurements in aluminum and plasma-sprayed aluminum coatings, 6:22956

**DEUTERIUM COMPOUNDS**

**Exchange Interactions**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319

**Magnetic Susceptibility**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319

**Neutron Diffraction**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319

**Photolysis**
Development of advanced technologies for photochemical tritium recovery. Quarterly progress report, January 1, 1980-March 31, 1980, 6:22394 (UCID—18509-80-1)

**Spin Waves**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1\text{-}c/Cl_3$, 6:22319

**DEUTERON REACTIONS**

**Pickup Reactions**
Studies on a high-grade polarized lithium-6 target, 6:22506 (ANL-Trans—1195)

**DEUTERON-DEUTERON INTERACTIONS**
*See DEUTERON REACTIONS*

**DEVELOPED COUNTRIES**

**Employment**
Effect of OPEC oil pricing on output, prices, and exchange rates in the United States and other industrialized countries, 6:21588

**Inflation**
Effect of OPEC oil pricing on output, prices, and exchange rates in the United States and other industrialized countries, 6:21588

**DEVELOPING COUNTRIES**

**Energy Conservation**
Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))

**Energy Consumption**
Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))

**Energy Demand**
Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))

**Energy Source Development**
Annual review of energy. Volume 5 (Book), 6:22122

**DEVONIAN SHALES**
*See BLACK SHALES*

**DEXTRAN**

**Copolymerization**
Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310

**DIAMOND DRILLING EQUIPMENT**
*See DRILLING EQUIPMENT*

**DIAMONDS**

**Infrared Radiation**
Infrared refractive index of diamond, 6:22320

**Refractivity**
Infrared refractive index of diamond, 6:22320

**DIAPHRAGMS (THERMONUCLEAR DEVICE)**
*See LIMITERS*

**1,3-DIAZINES**
*See PYRIMIDINES*

**1,4-DIAZINES**
*See PYRAZINES*

**DIBENZOPYRROLES**
*See CARBAZOLES*

**DIELECTRIC MATERIALS**

**Nonlinear Optics**
Nonlinear refractive index $N_2$ of transparent dielectric crystals, 6:22863 (UCRL-Trans—11663)

**DIELECTRICS**
*See DIELECTRIC MATERIALS*

**DIESEL ENGINES**

**Combustion Products**
Tumorigenesis of diesel exhaust, gasoline exhaust, and related emission extracts on SENCAR mouse skin, 6:22702 (CONF-800323—4)

**Exhaust Gases**
Soot reduction in diesel engines: a chemical approach, 6:22260

**DIESEL FUELS**

**Fuel Additives**
Soot reduction in diesel engines: a chemical approach, 6:22260

**DIFFERENTIAL EQUATIONS**

**Computer Codes**
Type-insensitive ODE codes based on implicit A-stable formulas, 6:22968

**DIFFUSE SOLAR RADIATION**

**Correlations**
Basis and effects of inaccuracies in diffuse radiation correlations, 6:21745

**DIGITAL SYSTEMS**

**Timing Properties**
Verification of timing constraints on large digital systems, 6:22981 (UCRL—83791(Rev.1))

**DIMERS**

**Quantitative Chemical Analysis**
Measurement of pyrimidine dimers in spheroplasts of Bacillus subtilis, 6:22701

**DIODES (SEMICONDUCTOR)**
*See SEMICONDUCTOR DIODES*

**DIOLS**
*See GLYCOLS*

**DIRAC MONOPOLES**
*See MAGNETIC MONOPOLES*

**DIRECT CONTACT HEAT EXCHANGERS**

**Performance**
Direct contact liquid-liquid heat exchanger for solar-heated and -cooled buildings. Final report, January 1, 1979-May 30, 1980, 6:21852 (DOE/CS/32867—T1)

**DIRECT GAIN SYSTEMS**

**Computer Calculations**
Williamson house as simulated by the DEROB system: a field validation, 6:21919

**Design**
Design of a super-insulated energy education center, 6:21912

**Performance**
Prediction of direct gain solar heating system performance, 6:21925
Williamson house as simulated by the DEROB system: a field validation, 6:21919

**Thermal Insulation**
Klegecell: a new lightweight insulating material with superior properties, 6:21906

**DISK MHD GENERATORS**

**Inhomogeneous Plasma**
Open cycle disk generator program. Task 2, 6:22147 (DOE/ET/15518—3)

**DISPERSANTS (CHEMICAL)**
*See SURFACTANTS*

**DISPERSED STORAGE AND GENERATION**
**Cost Benefit Analysis**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume I. Final report, 6:22128 (DOE/JPL/955456—1(Vol.1))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume V. Final report, Appendix D: cost-benefit considerations for providing dispersed storage and generation for electric utilities, 6:22132 (DOE/JPL/955456—1(Vol.5))
**Economic Analysis**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume III. Final report, Appendix B: state of the art, trends, and potential growth of selected DSG technologies, 6:22130 (DOE/JPL/955456—1(Vol.3))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume IV. Final report, Appendix C: identification from utility visits of present and future approaches to integration of DSG into distribution networks, 6:22131 (DOE/JPL/955456—1(Vol.4))
**Feasibility Studies**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume I. Final report, 6:22128 (DOE/JPL/955456—1(Vol.1))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume IV. Final report, Appendix C: identification from utility visits of present and future approaches to integration of DSG into distribution networks, 6:22131 (DOE/JPL/955456—1(Vol.4))
**Market**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume III. Final report, Appendix B: state of the art, trends, and potential growth of selected DSG technologies, 6:22130 (DOE/JPL/955456—1(Vol.3))
**Monitoring**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume I. Final report, 6:22128 (DOE/JPL/955456—1(Vol.1))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume II. Final report, Appendix A: selected DSG technologies and their general control requirements, 6:22129 (DOE/JPL/955456—1(Vol.2))
**Planning**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume IV. Final report, Appendix C: identification from utility visits of present and future approaches to integration of DSG into distribution networks, 6:22131 (DOE/JPL/955456—1(Vol.4))
**Remote Control**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume I. Final report, 6:22128 (DOE/JPL/955456—1(Vol.1))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume II. Final report, Appendix A: selected DSG technologies and their general control requirements, 6:22129 (DOE/JPL/955456—1(Vol.2))
**Technology Assessment**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume II. Final report, Appendix A: selected DSG technologies and their general control requirements, 6:22129 (DOE/JPL/955456—1(Vol.2))

**DISSOLVERS**
**Hydrodynamics**
Hydrodynamics of coal-liquefaction dissolver configurations, 6:21514 (ORNL/MIT—326)

**DISTILLATES**
**Mutagen Screening**
Studies of the biology and toxicology of oilshale materials, 6:22705 (LA-UR—81-1166)
**Toxicity**
Studies of the biology and toxicology of oilshale materials, 6:22705 (LA-UR—81-1166)

**DISTRICT HEATING**
**Economic Analysis**
Economics of power plant district and process heating in Richland, Washington, 6:22255 (PNL—3719)
**Waste Heat Utilization**
Economics of power plant district and process heating in Richland, Washington, 6:22255 (PNL—3719)
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)

**DIURNAL VARIATION**
*See DAILY VARIATIONS*

**DNA**
*(Deoxyribonucleic acid.)*
**Biological Radiation Effects**
Measurement of pyrimidine dimers in spheroplasts of Bacillus subtilis, 6:22701
**Biological Repair**
Use of lymphoblastoid cells for the estimation of environmental insults to DNA. Comprehensive report of the overall activities of the contract during the past three years. Progress report, August 1, 1978-June 31, 1981, 6:22704 (DOE/EV/02040—T1)
**Genetic Variability**
Evidence for nonrandom alterations in a fraction of the highly repetitive DNA of a eukaryote, 6:22639
**Polymerases**
HeLa cell DNA polymerase $\alpha$ is tightly associated with tryptophanyl-tRNA synthetase and diadenosine $5',5'''$-$P^1,P^4$-tetraphosphate binding activities, 6:22614
**Radiation Injuries**
Mechanisms for radiation damage in DNA. Progress report, January 1, 1980-December 31, 1980, 6:22673 (DOE/EV/02364—T1)

**DNA REPLICATION**
**Biological Effects**
Variants of 3T3 cells lacking mitogenic response to the tumor promoter tetradecanoyl-phorbol-acetate, 6:22632

**DOMESTIC SAFEGUARDS**
**Inventories**
Inventory verification methods in DOE safeguards inspections, 6:21704

**DORMITORIES**
*See RESIDENTIAL BUILDINGS*

**DOSEMETERS**
**Performance Testing**
Nuclear accident dosimetry: Los Alamos measurements at the seventeenth nuclear accident dosimetry intercomparison study at the Oak Ridge National Lab., DOSAR Facility, August 1980, 6:22860 (LA—8799-MS)
**Research Programs**
Nuclear criticality experiments and safety, 6:22079 (LA—8797-PR)

**DOSE-RESPONSE RELATIONSHIPS**
**Statistics**
Adjusting survival data for covariates, 6:22541 (CONF-801045—)

**DOSIMETRY**
*See also PERSONNEL DOSIMETRY*
**Research Programs**
Environmental Measurements Laboratory annual report, calendar year 1980, 6:22672 (DOE/EML—392)

**DOUBLE ENVELOPE BUILDINGS**
**Computerized Simulation**
Parametric evaluation of the double envelope building design using a detailed numerical thermal simulation model (Abstract only), 6:21845
**Heat Storage**
Ground coupling and single-blow thermal storage in a double-envelope house, 6:22169 (BNL—29480)
**Performance**
Parametric evaluation of the double envelope building design using a detailed numerical thermal simulation model (Abstract only), 6:21845

**DOUBLET 3 DEVICES**
*See DOUBLET REACTORS*

**DOUBLET REACTORS**
**Gettering**
Titanium gettering in Doublet III, 6:22927
**Surface Contamination**
Auger analysis of surface deposits formed by exposure to plasma discharges in Doublet III, 6:22900
**DOWNHOLE INFORMATION SYSTEMS**
*See MWD SYSTEMS*
**DOWTHERM**
*See BIPHENYL*
**DRAG EFFECT**
*See ELECTROPHORESIS*
**DRIFT CHAMBERS**
**Performance**
Wire chambers, 6:22512
**DRIFT INSTABILITY**
**Computerized Simulation**
Current-driven microinstabilities in a neutral sheet, 6:22891
**DRILL CORES**
**Permeability**
Use of microorganisms in enhanced oil recovery, 6:21569 (DOE/BC/10300—10)
**Sterilization**
Use of microorganisms in enhanced oil recovery, 6:21569 (DOE/BC/10300—10)
**DRILLING EQUIPMENT**
**Power Demand**
Coal gettability studies: methods of evaluation and verification of coal deposited in seams, 6:21552 (DOE/TIC—1016824)
**Research Programs**
Program for the improvement of downhole drilling motor bearings and seals. Phase IV. Final report, 6:21973 (SAND—81-7066)
**DRINKING WATER**
**Radiation Monitoring**
Uranium in US surface, ground, and domestic waters, 6:22597 (EPA—570/9-81-001(Vol.1))
**DROSOPHILA**
**Population Dynamics**
Trade-off between r-selection and K-selection in Drosophila populations, 6:22638
**DRY STORAGE**
**Evaluation**
Spent-fuel dry-storage-concept evaluation, 6:21683 (RHO-CD—972)
**DUCKS**
**Behavior**
Highway right-of-way: mowing versus succession as related to duck nesting, 6:22721
**DUMAND PROJECT**
**Computerized Simulation**
Angular and energy resolution of the DUMAND optical array, 6:22511 (DOE/ER/00511—T1)
**DYE LASERS**
**Laser Cavities**
Alternate model of CW dye laser intracavity absorption, 6:22440
**Performance**
Alternate model of CW dye laser intracavity absorption, 6:22440
**DYNAMICS (BEAM)**
*See BEAM DYNAMICS*
**DYSPROSIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**DYSPROSIUM ISOTOPES**
**Deformed Nuclei**
Particle angular momentum alignment effects in deformed nuclei, 6:22852
**DYSPROSIUM PHOSPHATES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**DYSPROSIUM SULFIDES**
**Antiferromagnetism**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Ferromagnetism**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Magnetization**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Neutron Diffraction**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Superconductivity**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Transition Temperature**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317

## E

**EARTH ATMOSPHERE**
*See also AIR*
*IONOSPHERE*
*STRATOSPHERE*
*TROPOSPHERE*
**Energy Budgets**
Study of the global energy balance, 6:22533 (UCRL—85958)
**Flow Models**
Scheme for computing surface fluxes from mean flow observations, 6:22534
**Weather**
Mechanism for the effects of variable solar activity on the weather. Final report, 6:22738 (DOE/ER/04634—1)
**EARTH-COVERED BUILDINGS**
**Stacks**
Passive ventilation of an underground bath house by the use of solar chimney, 6:21890
**Ventilation**
Passive ventilation of an underground bath house by the use of solar chimney, 6:21890
**EBR-2 REACTOR**
**Fuel Channels**
Studies of thermal-hydraulic phenomena in EBR-II, 6:22063
**ECCS**
*(Emergency core cooling system.)*
**Bypasses**
Evaluation of ECC bypass data with a nonlinear constrained MLE technique, 6:22067 (CONF-791016—)
**ECONOMIC ANALYSIS**
NBER working paper series: oil and the dollar. Working Paper No. 554, 6:21589
**ECR HEATING**
Electron-cyclotron resonance heating in plasmas with arbitrary stratification of the magnetic field, 6:22893
**EDS LIQUEFACTION**
*See EXXON LIQUEFACTION PROCESS*
**EDTA**
*(Ethylenediaminetetraacetic acid.)*
**Liquid Column Chromatography**
Determination of EDTA and HEDTA in Hanford defense waste by high-performance liquid chromatography, 6:22336 (RHO-SA—218)
**EHF RADIATION**
*See MICROWAVE RADIATION*
**EHV AC SYSTEMS**
**Environmental Impacts**
Proposed fiscal year 1981 program. Final environmental impact statement, 6:22010 (DOE/EIS—0060)

**Planning**
Proposed fiscal year 1981 program. Final environmental impact statement, 6:22010 (DOE/EIS—0060)
**Power Transmission Lines**
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:22015
**EHV DC SYSTEMS**
**Electric Cables**
Laboratory development of /plus or minus/600 kV dc pipe cable system, 6:22013
**Power Transmission Lines**
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:22015
**EIIP**
*See INDUSTRIAL PARKS*
**EINSTEINIUM 253**
**Chemical Preparation**
Techniques of microchemistry and their applications to some transcurium elements at Berkeley and Oak Ridge (Micro- to milligram scale), 6:22412
**Spectrophotometry**
Techniques of microchemistry and their applications to some transcurium elements at Berkeley and Oak Ridge (Micro- to milligram scale), 6:22412
**ELECTRIC APPLIANCES**
*See also AIR CONDITIONERS*
*DEHUMIDIFIERS*
*FREEZERS*
*REFRIGERATORS*
*STOVES*
*WATER HEATERS*
**Energy Consumption**
Progress in residential energy conservation: a multi country perspective, 6:22206 (LBL—11701)
**ELECTRIC BATTERIES**
*(Devices for production and/or storage of electrical energy from chemical reactions; excludes FUEL CELLS and RADIOISOTOPE BATTERIES.)*
*See also LEAD-ACID BATTERIES*
Implementation plan (May 1979): batteries for specific solar applications, 6:21773 (SAND—80-0216)
**Electrodes**
Electrochemical studies of the film formation on lithium in propylene carbonate solutions under open circuit conditions, 6:22090 (LBL—12102)
**Operation**
Electrochemical studies of the film formation on lithium in propylene carbonate solutions under open circuit conditions, 6:22090 (LBL—12102)
**Research Programs**
Applied battery and electrochemical research program report for fiscal year 1980, 6:22092 (LBL—12514)
**ELECTRIC CABLES**
*See also SUPERCONDUCTING CABLES*
**Design**
Laboratory development of /plus or minus/600 kV dc pipe cable system, 6:22013
**ELECTRIC LOGGING**
**Computer Codes**
Development and testing of FIDELE: a computer code for finite-difference solution to harmonic magnetic-dipole excitation of an azimuthally symmetric horizontally and radially layered earth, 6:22521 (SAND—81-0196)
**ELECTRIC MOTORS**
**Control Systems**
High response control of stator watts and vars for large wound rotor induction motor adjustable speed drives, 6:22962
**Cost**
Energy conservative motors, 6:22234 (CONF-8003114—)
**Efficiency**
Energy conservative motors, 6:22234 (CONF-8003114—)
**ELECTRIC POWER**
*See also HYDROELECTRIC POWER*
**Consumption Rates**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))
**Incremental-Cost Pricing**
Economics of electric utility backup for solar heating and hot water, 6:21748
**Prices**
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))
**Time-of-Use Pricing**
Correcting for truncation bias in the analysis of experiments in time-of-day pricing of electricity, 6:22139
**ELECTRIC POWER INDUSTRY**
**Research Programs**
Electrical Systems Division (Report section), 6:22135 (EPRI-P—1726-SR)
**ELECTRIC POWER RESEARCH INSTITUTE**
*See EPRI*
**ELECTRIC UTILITIES**
**Dispersed Storage and Generation**
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume I. Final report, 6:22128 (DOE/JPL/955456—1(Vol.1))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume II. Final report, Appendix A: selected DSG technologies and their general control requirements, 6:22129 (DOE/JPL/955456—1(Vol.2))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume III. Final report, Appendix B: state of the art, trends, and potential growth of selected DSG technologies, 6:22130 (DOE/JPL/955456—1(Vol.3))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume IV. Final

report, Appendix C: identification from utility visits of present and future approaches to integration of DSG into distribution networks, 6:22131 (DOE/JPL/955456—1(Vol.4))
Monitoring and control requirement definition study for dispersed storage and generation (DSG). Volume V. Final report, Appendix D: cost-benefit considerations for providing dispersed storage and generation for electric utilities, 6:22132 (DOE/JPL/955456—1(Vol.5))

**Fossil-Fuel Power Plants**
Coal Combustion Systems Division (Report section), 6:22461 (EPRI-P—1726-SR)

**Magnetic Energy Storage**
Superconducting magnetic energy storage applications and benefits for electric utility power systems, 6:22086

**Off-Peak Energy Storage**
Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)

**Power Demand**
End-use approach to demand forecasting, 6:22017

**Regulations**
Effects of regulation on the electric utility industry, 6:22602 (EMD—81-35)

**Research Programs**
1981-1985 research and development program plan: program descriptions, 6:22134 (EPRI-P—1726-SR)
Electrical Systems Division (Report section), 6:22135 (EPRI-P—1726-SR)
Energy Analysis and Environment Division (Report section), 6:22106 (EPRI-P—1726-SR)

**ELECTRIC-POWERED VEHICLES**

**DC to DC Converters**
Two-quadrant transistor chopper for electric vehicle drive, 6:22262

**Performance**
Vehicle test report: South Coast Technology electric cconversion of a Volkswagen Rabbit, 6:22261 (DOE/CS/54209—2)

**Power Supplies**
Two-quadrant transistor chopper for electric vehicle drive, 6:22262

**ELECTRODEPOSITION**

**Mathematical Models**
Electrical image deposition of charges from laminar flow in cylinders, 6:22664

**ELECTRODES**

**Design**
Microwave gaseous electrode development. Final report (Plasma torch), 6:22150 (DOE/ET/15619—T1)

**Performance Testing**
Microwave gaseous electrode development. Final report (Plasma torch), 6:22150 (DOE/ET/15619—T1)

**Protective Coatings**
Electrochemical studies of the film formation on lithium in propylene carbonate solutions under open circuit conditions, 6:22090 (LBL—12102)

**ELECTROMAGNETIC FIELDS**

**Chemical Reactions**
Inhibition of chemical reactions by a strong laser field, 6:22365

**Transformations**
Translation operator for finite dmensional electromagnetic fields, 6:22866 (UCID—19024)

**ELECTRON BEAMS**

**Beam Transport**
Mathematical models for the EPIC code, 6:22859 (UCID—19055)
Study of instabilities and emittance growth in periodic focusing systems for intense beams. Progress report, Technical report No. PP 81-198, 6:22467 (DOE/ER/05940—2)

**Cyclotron Radiation**
Characterization and suppression of zero-frequency cyclotron waves on relativistic electron beams, 6:22479
Simulation of slow cyclotron wave growth on a scattered relativistic electron beam, 6:22806

**Etching**
Exposure and development models used in electron beam lithography, 6:22458

**ELECTRON CONFIGURATION (ATOMS)**
*See ELECTRONIC STRUCTURE*

**ELECTRON CYCLOTRON-RESONANCE H**
*See ECR HEATING*

**ELECTRON MICROPROBE ANALYSIS**

**Data Processing**
Digitally controlled x-ray mapping, 6:22337 (SAND—81-0331C)

**ELECTRON REACTIONS**

**Elastic Scattering**
Exchange current effects in magnetic electron scattering from $^{49}$Ti, $^{51}$V, $^{59}$Co, $^{87}$Sr, and $^{93}$Nb, 6:22850

**Inelastic Scattering**
Orbital recoupling dominance in the A = 20 isovector giant M1 transition, 6:22849

**ELECTRON SOURCES**

**Design**
Pulsed WIP electron gun. Fabrication phase 1 x 40 cm and 1 x 70 cm cooled WIP electron gun. Final report, March 1979-December 1980, 6:22788 (UCRL—15327)

**Performance**
Pulsed WIP electron gun. Fabrication phase 1 x 40 cm and 1 x 70 cm cooled WIP electron gun. Final report, March 1979-December 1980, 6:22788 (UCRL—15327)

**ELECTRON-DEUTERON INTERACTIONS**

**Breakup Reactions**
Parity violation in electron-deuteron scattering I. Methodology and elastic scattering, 6:22830

**Elastic Scattering**
Parity violation in electron-deuteron scattering I. Methodology and elastic scattering, 6:22830

**P Invariance**
Parity violation in electron-deuteron scattering I. Methodology and elastic scattering, 6:22830

**ELECTRONIC EQUIPMENT**
*See also MICROWAVE EQUIPMENT*
*OSCILLATORS*
*RESONATORS*

**Meetings**
Automotive electronics, 6:22263

**ELECTRONIC STRUCTURE**
*(For electron configuration in atoms and molecules, and electron band structure in solids.)*

**Pressure Dependence**
Pressure-induced change in the Fermi surface and electronic structure of metals, 6:22279 (SAND—81-0558C)

**ELECTRON-MOLECULE COLLISIONS**

**Inelastic Scattering**
New, optically forbidden Rydberg series in $O_2$ converging to the $O^+_2$ c $^4S^-$/sub u/ limit, 6:22800

**ELECTRON-POSITRON INTERACTIONS**

**Particle Production**
Highlights of high energy pp, anti pp and $e^+e^-$ interactions, 6:22817 (BNL—29465)

**ELECTRON-PROTON INTERACTIONS**

**Deep Inelastic Scattering**
Internal spin structure of the proton from high energy polarized e-p scattering, 6:22825 (SLAC-PUB—2674)

**ELECTRONS**

**Biochemical Reaction Kinetics**
Redox titration of electron acceptor Q and the plastoquinone pool in Photosystem II, 6:22629

**Electron-Molecule Collisions**
Ab initio study of dissociative attachment of low-energy electrons to $F_2$, 6:22808

**ELECTROPHORESIS**

**Mathematical Models**
Estimation of two-dimensional electrophoretic spot intensities and positions by modeling, 6:22619

**Standardization**
Internal charge standardization for two-dimensional electrophoresis, 6:22620

**ELECTROSTATIC LENSES**

**Computerized Simulation**
Numerical simulation of the transport of intense beams of heavy ions in an electrostatic quadrupole system, 6:22473 (SLAC-PUB—2673)

**ELEMENTS**
*See also METALS*
**Imports**
Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979 (Imports these elements in 1974, demand in 1985 and 2000), 6:21538 (DOE/MC/08004—T8)
**Supply and Demand**
Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979 (Imports these elements in 1974, demand in 1985 and 2000), 6:21538 (DOE/MC/08004—T8)
**ELMO BUMPY TORUS**
**Magnetic Mirrors**
ELMO Bumpy Torus: An alternate concept to tokamaks and mirrors, 6:22904
**Plasma Heating**
ELMO Bumpy Torus: An alternate concept to tokamaks and mirrors, 6:22904
**Toroidal Configuration**
ELMO Bumpy Torus: An alternate concept to tokamaks and mirrors, 6:22904
**EMBRYONIC CELLS**
**Hybridization**
Dependence of herpes simplex virus type 1-induced cell fusion on cell type, 6:22650
**EMERGENCY CORE COOLING SYSTEM**
*See ECCS*
**EMS**
*(Ethyl methanesulfonate.)*
**Toxicity**
Cytotoxicity and mutagenicity of alkylating agents in cultured mammalian cells (CHO/HGPRT system): mutagen treatment in the presence or absence of serum, 6:22714
**EMULSIONS**
Linear oil displacement by the emulsion entrapment process, 6:21577
**END USE SECTOR**
*See COMMERCIAL SECTOR*
*INDUSTRY*
**ENDOSPERM**
**Microscopy**
Applications of image intensification to low level fluorescence studies of living cells, 6:22633
**ENERGY**
*See also GEOTHERMAL ENERGY*
*NUCLEAR ENERGY*
*SOLAR ENERGY*
Energy, entropy, and information, 6:22096 (CONF-8003114—)
**Decision Making**
Energy in transition 1985 to 2010: overview. Final report, 6:22097 (DOE/PE/03784—T1)
**Forecasting**
Energy in transition 1985 to 2010: overview. Final report, 6:22097 (DOE/PE/03784—T1)
**Research Programs**
Energy R and D in the private sector, 6:22105 (CONF-791016—)
**Reviews**
Annual review of energy. Volume 5 (Book), 6:22122
**ENERGY ANALYSIS**
**Energy Models**
Operating experience with LEAP from the perspective of the computing applications analyst, 6:22099 (ORNL/CSD/TM—141)
**Research Programs**
Energy Analysis and Environment Division (Report section), 6:22106 (EPRI-P—1726-SR)
**ENERGY AUDITS**
**Implementation**
Energy audit workbook: for local government and related agencies, 6:22257 (DOE/TIC—1022079)
**Information**
Energy audit workbook: for local government and related agencies, 6:22257 (DOE/TIC—1022079)
**Manuals**
Energy audit workbook: for local government and related agencies, 6:22257 (DOE/TIC—1022079)
Municipal energy conservation manual, 6:22252 (DOE/TIC—1021874)
**Regulations**
Guide to the adoption of energy conservation retrofit ordinances, 6:22111
**ENERGY CONSERVATION**
**Attitudes**
International Energy Conservation Month: an assessment, 6:22258 (DOE/TIC—1022137)
**Budgets**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Financial Data**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Financing**
Guidelines and input requirements for submitting energy management projects to DOE, 6:22115 (CONF-8003114—)
**Implementation**
DOE's in-house energy management program, 6:22113 (CONF-8003114—)
**Institutional Factors**
Institutional barriers to energy conservation in Mitchell-Lama housing, 6:22208 (NYSERDA—80-26)
**Manuals**
Energy conservation manual for water & wastewater facilities, 6:22251 (DOE/TIC—1021175)
Energy conservation manual: a guide for regional planning commission assistance to small municipalities, 6:22253 (DOE/TIC—1022897)
Guide to reducing energy use...budget costs. Volume II. Local energy management program, 6:22248 (DOE/CS/60419—T1)
**Meetings**
Proceedings of the energy conservation in design for UCC-ND managers and specialists, 6:22230 (CONF-8003114—)
**Public Opinion**
Public opinion about energy (Review), 6:22103
**Regulations**
Guide to the adoption of energy conservation retrofit ordinances, 6:22111
**Research Programs**
Conservation research and development, 6:22164 (CONF-8003114—)
Current energy research and development in Washington State, 1980, 6:22107 (WAOENG—80-17)
Guidelines and input requirements for submitting energy management projects to DOE, 6:22115 (CONF-8003114—)
**ENERGY CONSUMPTION**
**Surveys**
Estimating residential energy consumption from the national interim energy consumption survey: a progress report, 6:22163 (CONF-791016—)
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
Pacific Northwest residential energy survey. Volume 2. Technical appendix, 6:22179 (DOE/BP—13061(Vol.2))
**ENERGY CONVERSION**
*See also SOLAR ENERGY CONVERSION*
**Research Programs**
Energy Management and Utilization Division (Report section), 6:22137 (EPRI-P—1726-SR)
**ENERGY DEMAND**
**Computer Codes**
Model simplification: a case study of end use demand modeling in the transportation sector (DEMAND '81; ENTRANS;FOSSIL2), 6:22227 (LA-UR—81-813)
**Energy Models**
Model simplification: a case study of end use demand modeling in the transportation sector (DEMAND '81; ENTRANS;FOSSIL2), 6:22227 (LA-UR—81-813)
**Forecasting**
Input parameters for LEAP and analysis of the Model 22C data base, 6:22120 (ORNL—5746)

**ENERGY EFFICIENCY STANDARDS**
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes, 6:22195 (DOE/TIC—11454)
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: single-family dwellings, 6:22196 (DOE/TIC—11455)
Phase-two report for the development of Energy-Performance Standards for new buildings. Final report, 6:22198 (DOE/TIC—11457)
**Implementation**
Analysis of institutional issues in the implementation of Federal energy-performance standards for new buildings, 6:22212 (PNL—3312)
Improved data and procedures needed for development and implementation of building energy performance standards, 6:22204 (EMD—81-2)
**Institutional Factors**
Analysis of institutional issues in the implementation of Federal energy-performance standards for new buildings, 6:22212 (PNL—3312)
**ENERGY FACILITIES**
*See also RESOURCE RECOVERY FACILITIES*
**Program Management**
Office of the Inspector General. Annual report, 6:22967 (DOE/IG—0008/1)
**ENERGY INFORMATION ADMINISTRATION**
**Data Analysis**
Final summary report on an analysis of selected energy information administration publications, 6:22989 (DOE/EIA/10313—T4)
**Information Validation**
Final summary report on an analysis of selected energy information administration publications, 6:22989 (DOE/EIA/10313—T4)
**ENERGY INTEGRATED INDUSTRIAL PARKS**
*See INDUSTRIAL PARKS*
**ENERGY MANAGEMENT**
Do's and don't in energy conservation design, 6:22114 (CONF-8003114—)
**Manuals**
Energy management workbook for local governments. Workbook 1: electrical energy, 6:22117 (DOE/BP—32)
Energy management handbook for state facilities, 6:22220
**Planning**
Link between traditional planning and energy management, 6:22112 (CONF-810140—1)
**ENERGY MANAGEMENT SYSTEMS**
ORNL Energy Management System, 6:22173 (CONF-8003114—)
**Economics**
Energy management and control system, Y-12 Plant, 6:22172 (CONF-8003114—)
**ENERGY MODELS**
**Computer Codes**
Model simplification: a case study of end use demand modeling in the transportation sector (DEMAND '81; ENTRANS;FOSSIL2), 6:22227 (LA-UR—81-813)
**Computerized Simulation**
End-use approach to demand forecasting, 6:22017
**Evaluation**
Operating experience with LEAP from the perspective of the computing applications analyst, 6:22099 (ORNL/CSD/TM—141)
Strategies for model evaluation, 6:22098 (CONF-791016—)
**ENERGY OPERATORS**
*See HAMILTONIANS*
**ENERGY POLICY**
*See also NATIONAL ENERGY PLAN*
**Economic Impact**
Projected effects of energy policies on agricultural water use and irrigation, 6:22101
**Public Opinion**
Public opinion about energy (Review), 6:22103
**ENERGY RECOVERY**
**Meetings**
Resource recovery '80 presentation summaries, 6:22244
**Technology Assessment**
Status report on energy recovery from municipal solid waste: technologies, lessons and issues. Information bulletin of the energy task force of the urban consortium, 6:22249 (DOE/IR/05106—T6)
**ENERGY SOURCE DEVELOPMENT**
**Environmental Impacts**
Annual review of energy. Volume 5 (Book), 6:22122
**Global Aspects**
Annual review of energy. Volume 5 (Book), 6:22122
**Planning**
Strategy papers prepared by the Implementation Group of the New England Energy Congress, 6:22119 (DOE/TIC—1022409)
**Regulations**
Energy issues (From Mineral Economics Symposium), 6:22123
Regulatory impact an oil development (From 1980 Mineral Economics Symposium), 6:22125
**Socio-Economic Factors**
Annual review of energy. Volume 5 (Book), 6:22122
**ENERGY SOURCES**
*See also FOSSIL FUELS*
*NUCLEAR FUELS*
*RENEWABLE ENERGY SOURCES*
*WAVE POWER*
*WIND POWER*
**Economic Analysis**
Economic impact of a laser-fusion breeder on the U.S. energy economy, 6:22910
**Research Programs**
Energy technology. Progress report, October-December 1980, 6:22043 (LA—8797-PR)
**Technology Assessment**
Energy technology. Progress report, October-December 1980, 6:22043 (LA—8797-PR)
**ENERGY STORAGE**
*See also ANNUAL ENERGY STORAGE*
*FLYWHEEL ENERGY STORAGE*
*MAGNETIC ENERGY STORAGE*
*OFF-PEAK ENERGY STORAGE*
**Budgets**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Financial Data**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Research Programs**
Energy Management and Utilization Division (Report section), 6:22137 (EPRI-P—1726-SR)
**ENERGY SUPPLIES**
**Budgets**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Environmental Impacts**
Annual review of energy. Volume 5 (Book), 6:22122
**Financial Data**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Forecasting**
Input parameters for LEAP and analysis of the Model 22C data base, 6:22120 (ORNL—5746)
**Global Aspects**
Annual review of energy. Volume 5 (Book), 6:22122
**Public Opinion**
Public opinion about energy (Review), 6:22103
**Socio-Economic Factors**
Annual review of energy. Volume 5 (Book), 6:22122
**ENERGY SYSTEMS**
**Mathematical Models**
Method for solving a specific energy system on a minicomputer, 6:22988
**ENERGY TRANSPORT**
**Economics**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)

**Feasibility Studies**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)
**ENEWETAK**
*See ENIWETOK*
**ENGINES**
*See also INTERNAL COMBUSTION ENGINES*
**Performance Testing**
Design and testing of a procedure for evaluating fuel-efficient crankcase lubricants, 6:21592 (DOE/BETC/RI—81/2)
**ENGLAND**
*See UNITED KINGDOM*
**ENHANCED RECOVERY**
*See also CARBON DIOXIDE INJECTION*
*MICROBIAL EOR*
**Chemistry**
Fundamentals of catalytic and thermal reactions. Catalysis for chemicals and fuels. Chemistry of enhanced oil recovery. Sulfur recovery and utilization, 6:21580
**ENIWETOK**
**Hydrology**
Geohydrology of Enewetak Atoll islands and reefs, 6:22726 (UCRL—85411)
**ENRICHED URANIUM**
**Gamma Spectroscopy**
Gamma-ray measurements for uranium enrichment standards, 6:22355
**ENTOMOLOGY**
*See INSECTS*
**ENTROPY**
Energy, entropy, and information, 6:22096 (CONF-8003114—)
**ENVIRONMENT**
**Planning**
Greater Caribbean Energy and Environment Future. Ad hoc working group report, Key Biscayne, Florida, October 26-28, 1980, 6:22104 (DOE/EV/10454—T1)
**ENVIRONMENTAL EXPOSURE PATHWAY**
**Biological Models**
Environmental toxicology: issues, problems, and challenges, 6:22551
**Mathematical Models**
Bioavailability of chemicals in aquatic environments, 6:22588
Biotransformation and fate of chemicals in the aquatic environment (Lead abstract), 6:22582
**ENVIRONMENTAL IMPACTS**
**Research Programs**
Energy Analysis and Environment Division (Report section), 6:22106 (EPRI-P—1726-SR)
**ENVIRONMENTAL TEMPERATURE**
*See AMBIENT TEMPERATURE*
**ENVIRONMENTAL TRANSPORT**
*See also RADIONUCLIDE MIGRATION*
**Biological Models**
Storage and transport of carbon by rivers, 6:22559 (CONF-8009140—)
**Global Aspects**
River transport of organic carbon to the ocean, 6:22566 (CONF-8009140—)
**Mathematical Models**
Computational codes for calculating dispersion from accidental releases of pollutants, 6:22543 (DP-MS—80-85)
Modeling the environmental fate of synthetic organic chemicals, 6:22590
**EOR**
*See ENHANCED RECOVERY*
**EPIDEMIOLOGY**
**Data Analysis**
General statistical data structure for epidemiologic studies of DOE workers, 6:22671 (CONF-801045—)
**EPILEPSY**
**Radioinduction**
Principal disease or cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22676 (FDA—81-8042)
**EPITHELIUM**
**Autoradiography**
Control of cell proliferation in rabbit lens epithelium, 6:22636
**Mitotic Index**
Control of cell proliferation in rabbit lens epithelium, 6:22636
**EPOXIDES**
**Chemiluminescence**
Specificity of chemiluminescence in the metabolism of benzo[a]pyrene to its carcinogenic diol epoxide, 6:22615
**EPOXY COMPOUNDS**
*See EPOXIDES*
**EPRI**
*See also ELECTRIC POWER*
**Research Programs**
1981-1985 research and development program plan: program descriptions, 6:22134 (EPRI-P—1726-SR)
Advanced Power Systems Division (Report section), 6:22136 (EPRI-P—1726-SR)
Coal Combustion Systems Division (Report section), 6:22461 (EPRI-P—1726-SR)
Electrical Systems Division (Report section), 6:22135 (EPRI-P—1726-SR)
Energy Analysis and Environment Division (Report section), 6:22106 (EPRI-P—1726-SR)
Energy Management and Utilization Division (Report section), 6:22137 (EPRI-P—1726-SR)
**EQUATIONS (DIFFERENTIAL)**
*See DIFFERENTIAL EQUATIONS*
**EQUILIBRIUM PLASMA**
**Magnetohydrodynamics**
Experimental and theoretical studies of the effects of nonuniformities in equilibrium magnetohydrodynamic flows, 6:22814
**EQUIPMENT**
*See also DRILLING EQUIPMENT*
*HEAT RECOVERY EQUIPMENT*
*MAGNETIC ENERGY STORAGE EQUIPMENT*
*MINING EQUIPMENT*
*POLLUTION CONTROL EQUIPMENT*
*SOLAR EQUIPMENT*
*THERMAL ENERGY STORAGE EQUIPMENT*
*WELL LOGGING EQUIPMENT*
**Bids**
Application of penalty factors in procurement, 6:22233 (CONF-8003114—)
**Procurement**
Application of penalty factors in procurement, 6:22233 (CONF-8003114—)
**ERBIUM ISOTOPES**
**Deformed Nuclei**
Particle angular momentum alignment effects in deformed nuclei, 6:22852
**ERBIUM PHOSPHIDES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**ERBIUM SULFIDES**
**Antiferromagnetism**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Ferromagnetism**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Magnetization**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Neutron Diffraction**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Superconductivity**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Transition Temperature**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**ERYTHROCYTES**
**Behavior**
Modification of erythrocyte physicochemical properties by millimolar concentrations of glutaraldehyde, 6:22718

**Biochemistry**
Two-dimensional electrophoretic mapping of human erythrocyte proteins, 6:22622
**Deformation**
Modification of erythrocyte physicochemical properties by millimolar concentrations of glutaraldehyde, 6:22718
**ESTUARIES**
**Geochemistry**
Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries, 6:22562 (CONF-8009140—)
**ESTUARINE ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**ETCHING**
**Reviews**
Exposure and development models used in electron beam lithography, 6:22458
**ETHANE**
**Critical Temperature**
Effect of water upon the critical points of carbon dioxide and ethane, 6:22367
**1,2-ETHANEDIOL**
*See GLYCOLS*
**ETHANOL**
**Energy Substitution Equivalent**
Ethanol energy yield per gallon and potential petroleum displacement, 6:22140 (DOE/CE/56051—3)
**Energy Yield**
Ethanol energy yield per gallon and potential petroleum displacement, 6:22140 (DOE/CE/56051—3)
**ETHANOL PLANTS**
**Energy Conservation**
Energy conservation in ethanol production from renewable resources and non-petroleum energy sources, 6:21732 (DOE/CS/40352—T2)
**ETHERS**
**Chemical Bonds**
Quantitation of the reductive cleavage of aryl ethers of SRC and coals. Semi Annual report, September 1980-March 1981, 6:21507 (DOE/PC/30227—T1)
**Synthesis**
Quantitation of the reductive cleavage of aryl ethers of SRC and coals. Semi Annual report, September 1980-March 1981, 6:21507 (DOE/PC/30227—T1)
**ETHYLENE**
**Combustion**
Experimental study of the flowfield of a V-shaped premixed turbulent flame, 6:22415 (LBL—12141)
**ETHYLENE GLYCOL**
*See GLYCOLS*
**ETHYLENE POLYMERS**
*See POLYETHYLENES*
**ETHYLENEDIAMINETETRAACETIC ACID**
*See EDTA*
**ETHYLMETHANE SULFONATE**
*See EMS*
**EUPHORBIA**
**Productivity**
Hydrocarbons from plants: analytical methods and observations, 6:21805
**EUROPE**
*See also ITALY*
*POLAND*
*UNITED KINGDOM*
**Geothermal Resources**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)
**EUROPIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Solvent Extraction**
Mixed ligand chelate extraction of lanthanides with 5,7-dibromo-8-quinolinol systems, 6:22344
**EUROPIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**EUROPIUM PHOSPHATES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**EVACUATED TUBE COLLECTORS**
**Design**
Low-cost evacuated-tube solar collector. Final report, 6:21937 (DOE/CS/30133—T1(Vol.1))
Low-cost evacuated-tube solar collector appendices. Final report, 6:21938 (DOE/CS/30133—T1(Vol.2))
**Fabrication**
Low-cost evacuated-tube solar collector. Final report, 6:21937 (DOE/CS/30133—T1(Vol.1))
**Production**
Low-cost evacuated-tube solar collector. Final report, 6:21937 (DOE/CS/30133—T1(Vol.1))
**EVAPORATIVE COOLING**
**Performance**
Integrating optimized evaporative cooling systems with passive homes, concepts and results, 6:22218
**EVOLUTION**
*See BIOLOGICAL EVOLUTION*
**EXHAUST GASES**
**Gases**
Simulating interactions between turbulence and particles in erosive flow and transport, 6:22443 (UCRL—84691)
**EXPERIMENTAL BREEDER REACTOR-2**
*See EBR-2 REACTOR*
**EXPLOSIONS**
*See also ATMOSPHERIC EXPLOSIONS*
*NUCLEAR EXPLOSIONS*
**Data Acquisition Systems**
On-board data recorder for hard-target weapons, 6:22530 (UCRL—85730)
**EXPLOSIVE FRACTURING**
**Computerized Simulation**
Explosively produced fracture of oil shale, July-September 1979, 6:21607 (LA—8397-PR)
**EXXON DONOR SOLVENT LIQUEFACTION**
*See EXXON LIQUEFACTION PROCESS*
**EXXON GASIFICATION PROCESS**
**Process Heat**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)
**EXXON LIQUEFACTION PROCESS**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
**EYES**
*See also CRYSTALLINE LENS*
*RETINA*
**Biological Radiation Effects**
Cumulative probability of occurrence for ocular lesions in Segment III dogs, 6:22682 (FDA—81-8042)
Reduction in eye volume after prenatal or neonatal irradiation, 6:22683 (FDA—81-8042)

## F

**FABRY-PEROT INTERFEROMETER**
**Interference**
Analytic evaluation of interference effects on laser output in a Fabry-Perot resonator, 6:22438
**Resonators**
Analytic evaluation of interference effects on laser output in a Fabry-Perot resonator, 6:22438

**FACILITIES (ENERGY)**
*See ENERGY FACILITIES*
**FACILITIES (NUCLEAR)**
*See NUCLEAR FACILITIES*
**FACILITIES (RESOURCE RECOVERY)**
*See RESOURCE RECOVERY FACILITIES*
**FACILITIES (TEST)**
*See TEST FACILITIES*
**FALLOUT**
*(For radioactive fallout only.)*
**Data Compilation**
Radiochemical data collected on events from which radioactivity escaped beyond the borders of the Nevada test range complex, 6:22529 (UCRL—52934)
**Radiation Monitoring**
Environmental Measurements Laboratory annual report, calendar year 1980, 6:22672 (DOE/EML—392)
**FARADAY GENERATORS**
*See MHD GENERATORS*
**FARMS**
**Energy Consumption**
Michigan farm energy audit study: phase I, 6:22246
**Wind Turbines**
Wind energy for agricultural heating, 6:21990
**FAST BURST REACTOR FACILITY**
*See FBRF REACTOR*
**FAST FLUX TEST FACILITY REACTOR**
*See FFTF REACTOR*
**FASTENERS**
**Mechanical Vibrations**
Guy-cable design and damping for vertical-axis wind turbines, 6:21986 (SAND—80-2669)
**Stress Analysis**
Guy-cable design and damping for vertical-axis wind turbines, 6:21986 (SAND—80-2669)
**FATTY ACIDS**
*See CARBOXYLIC ACIDS*
**FBRF REACTOR**
**Spectral Hardening**
Radiation environment behind CdO loaded polyethylene conversion material exposed to a fast burst reactor, 6:22062 (SAND—81-0749C)
**FECES**
**Feasibility Studies**
Georgetown University Integrated Community Energy System (GU-ICES). Phase III, Stage I: feasibility analysis. Final report, 6:22192 (DOE/CS/20068—4(Vol.2)(App.))
**FEED MATERIALS PLANTS**
**Environmental Impact Statements**
Final environmental impact statement. Gas Hills Uranium Mill, Union Carbide Corporation, Natrona County, Wyoming, 6:22608
**Nuclear Materials Management**
Materials measurement and accounting in an operating plutonium conversion and purification process. Phase I. Process modeling and simulation, 6:21694 (LA—8809-MS)
**Solar Repowering**
Solar repowering/industrial retrofit systems study Gulf Mt. Taylor Uranium Mill solar retrofit system requirements specification, 6:21864 (MDC-G—8163A)
**FERMI LEVEL**
**Pressure Dependence**
Pressure-induced change in the Fermi surface and electronic structure of metals, 6:22279 (SAND—81-0558C)
**FERMILAB ACCELERATOR**
**Environmental Effects**
Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)
**Radiation Monitoring**
Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)
**FERMIUM**
**Chemistry**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:22413
**FERRATES**
*See IRON OXIDES*
**FERTILIZATION**
**Morphology**
Initial stages of sperm penetration into the egg of Fundulus heteroclitus, 6:22657
**FESHBACH-PORTER-WEISSKOPF MODEL**
*See OPTICAL MODELS*
**FETUSES**
**Immunoglobulins**
Gm allotypes in mother-father-cord trios: a selective transfer of autologous, fetal IgG to the mother, 6:22667
IgG levels in mother-father-cord trios: evidence for a large reduction of maternal IgG at birth, 6:22668
**Lymphocytes**
Distribution of T and B lymphocytes in blood and lymphoid tissues of fetal and adult sheep, 6:22634
**FFTF REACTOR**
**Fuel Pins**
Integrated quality status and inventory tracking system for fftf driver fuel pins, 6:22064
**Hot Cells**
Shield-verification survey of a large hot cell at the FFTF, 6:22059 (HEDL-SA—2044)
**Pipes**
Generic methods for design of small-bore pipe supports, 6:22060 (HEDL-SA—2275-FP)
**Primary Coolant Circuits**
Thermowell flow-induced vibrations measured in laboratory and FFTF plant piping, 6:22061 (HEDL-SA—2278-FP)
**Shielding**
Shield-verification survey of a large hot cell at the FFTF, 6:22059 (HEDL-SA—2044)
**Supports**
Generic methods for design of small-bore pipe supports, 6:22060 (HEDL-SA—2275-FP)
**Thermocouples**
Thermowell flow-induced vibrations measured in laboratory and FFTF plant piping, 6:22061 (HEDL-SA—2278-FP)
**FIBER OPTICS**
Signal enhancement by spectral equalization of high-frequency broadband signals transmitted through optical fibers, 6:22420 (LA-UR—81-1038)
**FIBROBLASTS**
**Mutants**
Variants of 3T3 cells lacking mitogenic response to the tumor promoter tetradecanoyl-phorbol-acetate, 6:22632
**FINISHING (SURFACE)**
*See SURFACE FINISHING*
**FINITE ELEMENT METHOD**
Finite element method with nonuniform mesh sizes for unbounded domains, 6:22986
**FIRE STATIONS**
*See PUBLIC BUILDINGS*
**FIREDAMP**
*See METHANE*
**FIRST WALL**
**Coatings**
Boron coatings on graphite for fusion reactor applications, 6:22959
Hydrogen retention and release in first-wall coatings for tokamaks, 6:22963
**FISCHER-TROPSCH SYNTHESIS**
**Comparative Evaluations**
Status of the Mobil process for converting methanol to high quality gasoline, 6:21527
**FISH CULTURE**
*See AQUACULTURE*
**FISHES**
**Toxins**
Survey of ciguatera at Enewetak and Bikini, Marshall Islands, with notes on the systematics and food habits of ciguatoxic fishes, 6:22573
**FISSIONABLE MATERIALS**
*(Materials containing nuclides capable of undergoing fission by any process.)*
**Qualitative Chemical Analysis**
LASL analytical chemistry program for fissionable materials safeguards, 6:21718

Nuclear materials analysis using plasma desorption mass spectometry, 6:21703

**FISSIONABLE MATERIALS MANAGEMENT**
*See NUCLEAR MATERIALS MANAGEMENT*

**FLAME PROPAGATION**
Experimental study of the flowfield of a V-shaped premixed turbulent flame, 6:22415 (LBL—12141)

**FLAMES**
**Inhibition**
Experimental and theoretical study of flame inhibition by bromine-containing compounds, 6:21731 (UCRL—85409)
**Mathematical Models**
Modelling of burning and extinction characteristics of a polymer diffusion flame and comparison with experiment, 6:22416 (LBL—12214)

**FLASH HYDROPYROLYSIS PROCESS**
Rockwell international gasifier--flash hydropyrolysis, 6:21523
**Mathematical Models**
CS/R Advanced Peat Hydrogasification Process, 6:21519
**Pilot Plants**
CS/R Advanced Peat Hydrogasification Process, 6:21519

**FLAT PLATE COLLECTORS**
**Materials**
Atmospheric corrosion of batten and enclosure materials for flat-plate solar collectors, 6:21936 (ANL/EES-TM—135)
**Performance**
Analysis and performance evaluation of an air thermosyphon system, 6:21908
**Simulation**
Analysis and performance evaluation of an air thermosyphon system, 6:21908
**Thermosyphon Effect**
Analysis and performance evaluation of an air thermosyphon system, 6:21908

**FLOW (FLUID)**
*See FLUID FLOW*

**FLOWMETERS**
**Comparative Evaluations**
Two-phase velocity and density in finite pipes by intrusive and nonintrusive instrumentation, 6:22074 (EGG-M—00881)
**Performance**
Commentary on differential-pressure measurements at high reference pressures, 6:22442 (EGG—1183-1800)

**FLUE GAS**
**Desulfurization**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Scrubbing**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)

**FLUID FLOW**
*See also INCOMPRESSIBLE FLOW*
*TURBULENT FLOW*
*TWO-PHASE FLOW*
**Brownian Movement**
Brownian motion in a flowing fluid revisited, 6:22815
**X-Ray Radiography**
PHERMEX applications to study high-pressure flow and detonation waves, 6:22524 (LA-UR—81-1270)

**FLUIDIZED BED**
**Performance Testing**
State of fluidized bed combustion technology, 6:22462

**FLUIDIZED-BED COMBUSTION**
**Fly Ash**
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)
**Solid Wastes**
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)
**Technology Assessment**
State of fluidized bed combustion technology, 6:22462

**FLUIDIZED-BED COMBUSTORS**
**Demonstration Programs**
Rivesville multicell fluidized-bed boiler. Annual technical progress report, July 1979-June 1980, 6:22460 (DOE/MC/16230—154)
**Fuel Feeding Systems**
Rivesville multicell fluidized bed boiler, 6:22003 (DOE/MC/16230—156)
**Materials**
AR and TD fossil-energy-materials program. Quarterly progress report, October-December 1980, 6:21513 (ORNL/FMP—81/1)
**Materials Handling Equipment**
Multi-stage desulfurizing fluid-bed combustor for coal-fired hot gas generator systems: Topical report No. 3. Task 6. Modifications to Materials Handling Equipment. Task 7. Testing, 6:22459 (DOE/ET/10484—T2)
**Operation**
Development support by ORNL for TVA AFBC Pilot Plant, 6:21992 (CONF-810567—1)
Multi-stage desulfurizing fluid-bed combustor for coal-fired hot gas generator systems: Topical report No. 3. Task 6. Modifications to Materials Handling Equipment. Task 7. Testing, 6:22459 (DOE/ET/10484—T2)
Rivesville multicell fluidized bed boiler. Annual technical progress report. July 1978-June 1979, 6:22001 (DOE/MC/16230—152)
Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, October-December 1979, 6:22002 (DOE/MC/16230—153)
Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, July-September 1980, 6:22006 (DOE/MC/16230—155)
**Performance**
Development support by ORNL for TVA AFBC Pilot Plant, 6:21992 (CONF-810567—1)
Multi-stage desulfurizing fluid-bed combustor for coal-fired hot gas generator systems: Topical report No. 3. Task 6. Modifications to Materials Handling Equipment. Task 7. Testing, 6:22459 (DOE/ET/10484—T2)
**Performance Testing**
Rivesville multicell fluidized bed boiler. Annual technical progress report. July 1978-June 1979, 6:22001 (DOE/MC/16230—152)
Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, October-December 1979, 6:22002 (DOE/MC/16230—153)
Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, July-September 1980, 6:22006 (DOE/MC/16230—155)

**FLUIDS**
*See also GASES*
*LIQUIDS*
**Phase Transformations**
Critical point correlations of the Yvon-Born-Green equation, 6:22875

**FLUORESCENCE**
**Microscopy**
Applications of image intensification to low level fluorescence studies of living cells, 6:22633

**FLUORESCENT LAMPS**
**Performance Testing**
Operating temperatures of recessed fluorescent fixtures with thermal insulation, 6:22210 (ORNL/Sub—7715/4)
**Temperature Measurement**
Operating temperatures of recessed fluorescent fixtures with thermal insulation, 6:22210 (ORNL/Sub—7715/4)

**FLUORIDES**
**Electron-Molecule Collisions**
Ab initio study of dissociative attachment of low-energy electrons to $F_2$, 6:22808
**Refractivity**
Nonlinear refractive index $N_2$ of transparent dielectric crystals, 6:22863 (UCRL-Trans—11663)

**FLUORINATED ALIPHATIC HYDROCARBONS**
*See also TEFLON*
**Photochemistry**
Ultraviolet laser photochemistry of $CF_2Cl_2$, 6:22402

**FLUORINE**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Atom-Molecule Collisions**
Classical trajectory models for electronically nonadiabatic collision processes: A classical valence bond model for electronic degrees of freedom, 6:22801
**Leaching**
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
**FLUORINE 20**
**M1-Transitions**
Orbital recoupling dominance in the A = 20 isovector giant M1 transition, 6:22849
**FLUORINE IONS**
**Lamb Shift**
Precision determinations of high Z hydrogenic ion Lamb shifts, 6:22761 (ANL—80-126)
**FLY ASH**
**Leaching**
Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)
**Recycling**
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)
**Waste Product Utilization**
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)
Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)
**FLYWHEEL ENERGY STORAGE**
**Design**
Performance characteristics of solar-photovoltaic flywheel-storage systems, 6:21762 (DOE/ET/20279—134)
**Performance Testing**
Performance characteristics of solar-photovoltaic flywheel-storage systems, 6:21762 (DOE/ET/20279—134)
**FLYWHEELS**
**Failure Mode Analysis**
Safety of isotropic flywheels, 6:22087 (UCRL—84347)
**Safety**
Safety of isotropic flywheels, 6:22087 (UCRL—84347)
**FMIT LINAC**
**Heat Transfer**
Simulation of the fusion materials irradiation test facility lithium and heat transport systems for abnormal events study, 6:22912 (HEDL-SA—2253)
**FOCK METHOD**
*See HARTREE-FOCK METHOD*
**FOOD INDUSTRY**
*See also DAIRY INDUSTRY*
**Geothermal Process Heat**
Pahoa geothermal industrial park. Engineering and economic analysis for direct applications of geothermal energy in an industrial park at Pahoa, Hawaii, 6:21977 (DOE/ET/27233—T3)
**Process Heat**
Economics of power plant district and process heating in Richland, Washington, 6:22255 (PNL—3719)
**FORMATION WATER**
*See INTERSTITIAL WATER*
**FORMIC ACID**
**Chromatography**
Continuous chromatographic reactor, 6:22361
**FOSSIL FUELS**
*See also COAL*
*NATURAL GAS*
*OIL SANDS*
*OIL SHALES*
*PEAT*
*PETROLEUM*
*SHALE OIL*
*SYNTHETIC FUELS*
**Chemical Analysis**
Bio/organic analysis section, 6:22334 (ORNL—5738)
**Research Programs**
Current energy research and development in Washington State, 1980, 6:22107 (WAOENG—80-17)
**FOSSIL-FUEL POWER PLANTS**
*See also ELECTRIC UTILITIES*
**Air Pollution**
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))
**Boiler Fuels**
Pilot plant tests of peat for direct combustion in utility boilers, 6:21563
**Boilers**
Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)
**Chemical Effluents**
Regional and national $SO_2$ emissions, 6:21541 (ANL/EES-TM—130)
Regional and national NO/sub x/ emissions, 6:22537 (ANL/EES-TM—130)
**Comparative Evaluations**
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**Cost Benefit Analysis**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**Cyclone Separators**
Electrocyclone development program. Quarterly technical report, November 1980-January 1981, 6:22000 (DOE/ET/17091—T1)
**Economic Impact**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Employment**
Construction-employment opportunities of four oil-replacing space-heating alternatives for core areas of thirteen major northeastern and midwestern cities, 6:22100 (ANL/CNSV—19)
**Environmental Effects**
Emissions inventory for the SURE Region. Final report, 6:22545 (EPRI-EA—1913)
**Flue Gas**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Fluidized-Bed Combustors**
Rivesville multicell fluidized bed boiler. Annual technical progress report. July 1978-June 1979, 6:22001 (DOE/MC/16230—152)
Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, October-December 1979, 6:22002 (DOE/MC/16230—153)
Rivesville multicell fluidized-bed boiler. Quarterly technical progress report, July-September 1980, 6:22006 (DOE/MC/16230—155)
Rivesville multicell fluidized bed boiler, 6:22003 (DOE/MC/16230—156)
**Gaseous Wastes**
Emissions inventory for the SURE Region. Final report, 6:22545 (EPRI-EA—1913)
**Permit Applications**
Coal-fired powerplants' Federal permit status report. Fourth edition (As of November 1980), 6:22005
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))
**Pollution Regulations**
Assessment of the proposed legislation, 6:22553 (ANL/EES-TM—130)

**Productivity**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**Regulations**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**Research Programs**
1981-1985 research and development program plan: program descriptions, 6:22134 (EPRI-P—1726-SR)
Coal Combustion Systems Division (Report section), 6:22461 (EPRI-P—1726-SR)
**Scrubbing**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Site Selection**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Social Impact**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Steam Generators**
Assessment of the use of human factors in the design of fossil-fired steam-generating systems. Final report, 6:22004 (EPRI-CS—1760)
**FOUNDATIONS**
**Electric Impedance**
Impedance characteristics of large tower footings to a 100/mu/s wide square wave of current, 6:22016
**FRACTURES**
**Evaluation**
Direct observation of explosively induced damage in sandstone with application to reservoir stimulation, 6:21605 (UCRL—85331(Rev.1))
**FREE CONVECTION**
*See NATURAL CONVECTION*
**FREE RADICALS**
*See RADICALS*
**FREEZERS**
**Thermal Insulation**
Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)
**FRESH WATER**
**Chemical Analysis**
Approaches to estimating microbial degradation of chemical contaminants in freshwater ecosystems, 6:22586
**FRESH WATER ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**FRESNEL LENS**
**Efficiency**
Compatibility of Fresnel lenses and photovoltaic cells in concentrator modules, 6:21777 (SAND—81-1191C)
**FTR REACTOR**
*See FFTF REACTOR*
**FUEL ADDITIVES**
**Performance**
Soot reduction in diesel engines: a chemical approach, 6:22260
**FUEL ASSEMBLIES**
**After-Heat Removal**
Sodium natural convection testing in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility (LMFBR), 6:22072 (CONF-810553—1)
**Autoradiography**
In-situ verification techniques for fast critical assembly cores, 6:21717
**Heat Transfer**
Sodium natural convection testing in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility (LMFBR), 6:22072 (CONF-810553—1)
**Nondestructive Analysis**
System for nondestructive assay of spent fuel subassemblies--comparison of calcuations and measurements, 6:21646
**Radiometric Analysis**
New developments in nondestructive measurement and verification of irradiated lwr fuels, 6:21716
**FUEL CELL POWER PLANTS**
**Cogeneration**
Thin film battery/fuel cell power generation system. Topical report covering Task 5: the design, cost and benefit of an industrial cogeneration system, using a high-temperature solid-oxide-electrolyte (HTSOE) fuel-cell generator, 6:22159 (DOE/ET/11305—T8)
**Economic Analysis**
Thin film battery/fuel cell power generation system. Topical report covering Task 5: the design, cost and benefit of an industrial cogeneration system, using a high-temperature solid-oxide-electrolyte (HTSOE) fuel-cell generator, 6:22159 (DOE/ET/11305—T8)
**FUEL CELLS**
*See also ACID ELECTROLYTE FUEL CELLS*
*MOLTEN CARBONATE FUEL CELLS*
**Research Programs**
Energy Management and Utilization Division (Report section), 6:22137 (EPRI-P—1726-SR)
**FUEL CHANNELS**
**Hydraulics**
Studies of thermal-hydraulic phenomena in EBR-II, 6:22063
**Thermal Analysis**
Studies of thermal-hydraulic phenomena in EBR-II, 6:22063
**FUEL COOLING INSTALLATIONS**
*See SPENT FUEL STORAGE*
**FUEL FABRICATION PLANTS**
**On-Line Measurement Systems**
Automated in-line measurement of nuclear fuel pellets, 6:21708
**Quality Assurance**
NDA for the SRP fuel fabrication process, 6:21706
**FUEL FEEDING SYSTEMS**
**Design**
Rivesville multicell fluidized bed boiler, 6:22003 (DOE/MC/16230—156)
**Performance**
Rivesville multicell fluidized bed boiler, 6:22003 (DOE/MC/16230—156)
**FUEL GAS**
*See also HIGH BTU GAS*
*INTERMEDIATE BTU GAS*
*LOW BTU GAS*
**Marketing Research**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)
**FUEL OILS**
*See also HEATING OILS*
**Availability**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)
**Combustion Products**
Influence of fuel sulfur on the selective reduction of NO by $NH_3$, 6:21596 (LBL—12128)
**Hydrocracking**
Critical evaluation of fuel-processing technologies for fuel cells. Quarterly report, December 1, 1980-February 28, 1981, 6:22160 (DOE/ET/17103—2)
**Prices**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)

**Supply and Demand**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)

**FUEL PINS**
**Coatings**
Oxygen getter coatings for fission reactor fuel pins, 6:22055
**Fission Product Release**
Irradiated mixed-oxide-fuel and fission-gas-release behavior during ex-reactor thermal-transient tests, 6:22036 (HEDL-SA—2175)
**Identification Systems**
Integrated quality status and inventory tracking system for fftf driver fuel pins, 6:22064
**Performance Testing**
Irradiated mixed-oxide-fuel and fission-gas-release behavior during ex-reactor thermal-transient tests, 6:22036 (HEDL-SA—2175)

**FUEL REPROCESSING PLANTS**
*See also IDAHO CHEMICAL PROCESSING PLANT*
**IAEA Safeguards**
Materials accounting considerations for international safeguards in a light-water reactor fuels reprocessing plant, 6:21715

**FUEL RODS**
*See also HOLLOW FUEL RODS*
**Stored Energy**
Nuclear fuel rod stored-energy uncertainty analysis: a study of error propagation in complicated models, 6:22068 (CONF-791016—)

**FUMES**
*See AEROSOLS*

**FUNGI**
**Saccharides**
Host-pathogen interactions. XV. Fungal glucans which elicit phytoalexin accumulation in soybean also elicit the accumulation of phytoalexins in other plants, 6:22649

**FUSION REACTORS**
*See THERMONUCLEAR REACTORS*

## G

**GADOLINIUM COMPOUNDS**
**Electron Spin Resonance**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)

**GADOLINIUM PHOSPHATES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)

**GAGES (PRESSURE)**
*See PRESSURE GAGES*

**GALLIUM ARSENIDE SOLAR CELLS**
**Fabrication**
Non-lattice-matched monolithic multicolor solar cell (AlGaAs/AlGaSb), 6:21801
**Graded Band Gaps**
Efficient use of the slar spectrum through the multiple junction cascade solar cell, 6:21802
Non-lattice-matched monolithic multicolor solar cell (AlGaAs/AlGaSb), 6:21801

**GALLIUM ARSENIDES**
**Annealing**
Pulsed-laser annealing of ion-implanted semiconducting GaAs for homojunction solar cells, 6:21760 (CONF-810526—28(Draft))
**Ion Implantation**
Pulsed-laser annealing of ion-implanted semiconducting GaAs for homojunction solar cells, 6:21760 (CONF-810526—28(Draft))
Time-resolved reflectivity during pulsed-laser irradiation of GaAs, 6:22314
**Reflectivity**
Time-resolved reflectivity during pulsed-laser irradiation of GaAs, 6:22314

**GAMMA DETECTION**
**High-Purity GE Detectors**
Charge sensitive preamplifier (12 Mar 1981) (Engineering Materials), 6:22509 (CAPE—2690)

**GAMMA SPECTROSCOPY**
**Accuracy**
Gamma-ray measurements for uranium enrichment standards, 6:22355
**Coincidence Methods**
Method for determining the neutron multiplicity for gamma rays from (particle,xnγ) reactions (n-γ coincidence), 6:22845

**GAMOW-TELLER RULES**
**Strength Functions**
Gamow-Teller strength distribution in the vicinity of A = 90. Pt. 1. Schematic calculation of GT strength in $^{90,92,94}$Nb, 6:22853

**GAS COOLANTS**
*See GASES*

**GAS COOLED FAST BREEDER REACTOR**
*See GCFR REACTOR*

**GAS COOLED REACTORS**
*See also HTGR TYPE REACTORS*
**Uses**
Special applications of gas-cooled reactors, 6:22050 (GA-A—16262)

**GAS ENGINES**
*See INTERNAL COMBUSTION ENGINES*

**GAS SPILLS**
**Computerized Simulation**
Computer modeling of massive LNG spills from storage tanks at Point Conception, Oxnard, and Los Angeles Harbor, California, 6:21601

**GAS TURBINE POWER PLANTS**
**Combustors**
Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)
**Liquid Fuels**
Fundamental characterization of alternative fuel effects in continuous combustion systems. Summary technical progress report, 1 February 1980-31 March 1981, 6:21998 (DOE/ET/11313—1)

**GAS TURBINES**
**Design**
Development of high-temperature turbine subsystem technology to a technology readiness status, Phase II. Quarterly report, January-March 1981, 6:21995 (DOE/ET/10340—T4)
High-temperature turbine technology program. Turbine subsystem design report: Low-Btu gas, 6:21994 (DOE/ET/10340—T3)
**Performance**
High-temperature turbine technology program. Turbine subsystem design report: Low-Btu gas, 6:21994 (DOE/ET/10340—T3)
**Protective Coatings**
Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils, 6:21999 (DOE/ET/12292—T1)
**Research Programs**
High-temperature-turbine technology program. Phase II. Technology test and support studies. Technical progress report, April 1, 1979-June 30, 1979, 6:21996 (DOE/ET/10348—T2)
**Technology Assessment**
Development of high-temperature turbine subsystem technology to a technology readiness status, Phase II. Quarterly report, January-March 1981, 6:21995 (DOE/ET/10340—T4)
High-temperature-turbine technology program. Phase II. Technology test and support studies. Technical progress report, April 1, 1979-June 30, 1979, 6:21996 (DOE/ET/10348—T2)

**GASEOUS DIFFUSION PROCESS**
**Energy Recovery**
Power recovery and utilization program applicable to the gaseous diffusion process, 6:22237 (CONF-8003114—)
**GASES**
*See also AIR*
*EXHAUST GASES*
*FLUE GAS*
*FUEL GAS*
*HIGH BTU GAS*
*INTERMEDIATE BTU GAS*
*LOW BTU GAS*
*NATURAL GAS*
*RARE GASES*
*SYNTHESIS GAS*
**Beam Transport**
Mathematical models for the EPIC code, 6:22859 (UCID—19055)
**GASOLINE**
*See also MOBIL M-GASOLINE PROCESS*
**Cost**
Status of the Mobil process for converting methanol to high quality gasoline, 6:21527
**Energy Demand**
Some factors influencing estimators in motor gasoline demand models, 6:22224 (CONF-801045—)
**GCFR REACTOR**
**Reactor Cores**
Thermomechanics, 6:22037 (LA—8797-PR)
**Shielding**
GCFR plenum shield design: exit shield experiment, 6:22040 (ORNL/TM—7715)
GCFR plenum shield design: shield heterogeneity experiment, 6:22039 (ORNL/TM—7714)
**GELS**
**Aging**
Analysis of glass shell blowing gases from metal-organic gels, 6:22948
**Gas Chromatography**
Analysis of glass shell blowing gases from metal-organic gels, 6:22948
**Mass Spectroscopy**
Analysis of glass shell blowing gases from metal-organic gels, 6:22948
**Pyrolysis**
Analysis of glass shell blowing gases from metal-organic gels, 6:22948
**Transformations**
Analysis of glass shell blowing gases from metal-organic gels, 6:22948
**GENERATORS (PULSE)**
*See PULSE GENERATORS*
**GENERATORS (STEAM)**
*See STEAM GENERATORS*
**GENETIC VARIABILITY**
**Population Dynamics**
Study of mathematical models of mutation and selection in multi-locus systems. Annual progress report, October 1, 1980-September 30, 1981, 6:22637 (DOE/EV/02472—T1)
**GEOLOGIC DEPOSITS**
*See also COAL DEPOSITS*
*NATURAL GAS DEPOSITS*
*PETROLEUM DEPOSITS*
*SALT DEPOSITS*
*URANIUM DEPOSITS*
**Correlations**
Correlation characteristics of surficial deposits with a description of surficial stratigraphy in the Nevada test site region, 6:22722 (DOE/ET/44802—T1)
**GEOLOGIC FORMATIONS**
**Fracturing**
Transient stress analysis of high-energy gas-fracture experiments, 6:21604 (SAND—81-0703)
**GEOLOGIC STRUCTURES**
**Detection**
Applications of reflection seismics to mapping coal-seam structure and discontinuities, 6:21546 (SAND—81-1069C)
**GEOLOGICAL SURVEYS**
**Calibration Standards**
Dynamic Test Range I: follow-on. Narrative report, 6:21625 (GJBX—110-81)
**GEOPHYSICAL SURVEYS**
*See also MAGNETIC SURVEYS*
*RADIOMETRIC SURVEYS*
*SEISMIC SURVEYS*
**Reviews**
Geophysical examination of coal deposits, 6:21545 (ICTIS/TR—13)
**GEOPRESSURED SYSTEMS**
**Economic Analysis**
Operations research and systems analysis of geopressured/geothermal resources in Texas. Final report, 6:21966 (DOE/ET/27087—T1)
**Geology**
Using presence of calcite cap rock in shales to predict occurrence of reservoirs composed of leached secondary porosity in the geopressured zone. Annual report, June 1, 1980-October 31, 1980, 6:21958 (DOE/ET/27111—2)
**Ground Subsidence**
Problem definition study of subsidence caused by geopressured geothermal resource development, 6:21969 (LBL—12392)
**Resource Assessment**
Operations research and systems analysis of geopressured/geothermal resources in Texas. Final report, 6:21966 (DOE/ET/27087—T1)
**GEOTHERMAL ENERGY**
**Budgets**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Financial Data**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**GEOTHERMAL POWER PLANTS**
**Design**
Baca Geothermal Demonstration Project. Quarterly technical progress report, April 1-June 30, 1980, 6:21970 (DOE/ET/27163—1)
**Planning**
Baca Geothermal Demonstration Project. Quarterly technical progress report, April 1-June 30, 1980, 6:21970 (DOE/ET/27163—1)
**Research Programs**
Advanced Power Systems Division (Report section), 6:22136 (EPRI-P—1726-SR)
**GEOTHERMAL PROCESS HEAT**
**Economic Analysis**
Pahoa geothermal industrial park. Engineering and economic analysis for direct applications of geothermal energy in an industrial park at Pahoa, Hawaii, 6:21977 (DOE/ET/27233—T3)
**Feasibility Studies**
Pahoa geothermal industrial park. Engineering and economic analysis for direct applications of geothermal energy in an industrial park at Pahoa, Hawaii, 6:21977 (DOE/ET/27233—T3)
**GEOTHERMAL RESOURCES**
**Appraisal**
Identification of geothermal reserves and estimation of their value, 6:21967 (LBL—11940)
**Calculation Methods**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)
**Environmental Impacts**
Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: an update, 6:21957 (USGS-OFR—80-490)
**Institutional Factors**
Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: an update, 6:21957 (USGS-OFR—80-490)
**Legal Aspects**
Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: an update, 6:21957 (USGS-OFR—80-490)
**Resource Assessment**
Evaluation of geothermal energy in Arizona. Arizona geothermal planning/commercialization team. Quarterly topical progress report, July 1-September 30, 1980, 6:21955 (DOE/RA/50076—T3)

**Resource Development**
Evaluation of geothermal energy in Arizona. Arizona geothermal planning/commercialization team. Quarterly topical progress report, July 1-September 30, 1980, 6:21955 (DOE/RA/50076—T3)

**GEOTHERMAL WELLS**
**Fluid Injection**
Two-dimensional temperature distribution surrounding an injection well, 6:21573 (SAND—81-0101C)
**Well Logging**
Preliminary geological interpretation and lithologic log of the exploratory geothermal test well (INEL-1), Idaho National Enginering Laboratory, eastern Snake River Plain, Idaho, 6:21962 (USGS-OFR—79-1248)

**GERMANIUM COMPOUNDS**
**Specific Heat**
Fluctuation heat capacity of amorphous $Nb_3Ge$ films, 6:22291

**GETTERS**
**Glow Discharges**
Effect of hydrogen glow discharge conditioning on Zr/Al getter pumps, 6:22929

**GIANT CELLS**
*See TUMOR CELLS*

**GIROMILL TURBINES**
**Water Brakes**
Wind driven direct water heating system development and field testing, 6:21989

**GLASS**
**Cleaning**
Cleaning procedure for inertial fusion targets, 6:22936
**Coatings**
Recent advances in Pt coating of microspheres by a batch magnetron sputtering process, 6:22938
**Shells**
Furnace profile effects on glass shell formation, 6:22949
**Sputtering**
Recent advances in Pt coating of microspheres by a batch magnetron sputtering process, 6:22938
**Surface Treatments**
Chemical durability improvement of glass shells, 6:22947
**Tensile Properties**
Tensile testing of glass microshells, 6:22950
**X Radiation**
Analysis of x-ray emission and tritium content from glass Microshell inertial fusion targets, 6:22945
**X-Ray Spectra**
Analysis of x-ray emission and tritium content from glass Microshell inertial fusion targets, 6:22945

**GLIOBLASTOMAS**
*See NEOPLASMS*

**GLOVEBOXES**
**Buildup**
In-line monitor of plutonium holdup in glovebox filters, 6:21707
**On-Line Measurement Systems**
In-line monitor of plutonium holdup in glovebox filters, 6:21707

**GLUCOCORTICOIDS**
**Receptors**
Cell surface modulation of gene expression in brain cells by down regulation of glucocorticoid receptors, 6:22617

**GLUCOSE**
**Biodegradation**
Role of biodegradation kinetics in predicting environmental fate, 6:22589
**Metabolism**
Comparison of $^{13}C$ nuclear magnetic resonance and $^{14}C$ tracer studies of hepatic metabolism, 6:22613

**GLUTARIC ACID**
**Electron Spectra**
Photoelectron spectroscopy of carbonyls: saturated normal dicarboxylic acids, 6:22382

**GLYCIDES**
*See SACCHARIDES*

**GLYCOGEN**
**Biosynthesis**
Comparison of $^{13}C$ nuclear magnetic resonance and $^{14}C$ tracer studies of hepatic metabolism, 6:22613

**GLYCOLS**
**Physical Properties**
Proprties of the Carrol system and a machine design for solar-powered, air-cooled, absorption space cooling. Phase I and Phase II. Final report, September 1977-March 1979, 6:21851 (DOE/CS/31587—T2)

**GRADED BAND GAPS**
**Fabrication**
Non-lattice-matched monolithic multicolor solar cell (AlGaAs/AlGaSb), 6:21801
**Semiconductor Materials**
Efficient use of the slar spectrum through the multiple junction cascade solar cell, 6:21802

**GRAFT POLYMERS**
**Chemical Preparation**
Water-soluble copolymers. I. Synthesis of model dextran-g-polyacrylamides by $Fe(II)/H_2O_2$ initiation and characterization by aqueous size exclusion chromatography (For use as viscosity modifiers for enhanced oil recovery), 6:21574

**GRANITES**
**Thermal Conduction**
Finite element model for heat conduction in jointed rock masses, 6:21684 (SAND—80-2016)

**GRANTS**
**Audits**
Office of the Inspector General. Annual report, 6:22967 (DOE/IG—0008/1)

**GRANULAR BED FILTERS**
**Gas Flow**
Granular bed filter development program, Phase II. Quarterly report, June-August 1980, 6:21997 (DOE/ET/10373—T6)
**Research Programs**
Granular bed filter development program, Phase II. Quarterly report, June-August 1980, 6:21997 (DOE/ET/10373—T6)

**GRANULOCYTES**
*See LEUKOCYTES*

**GRAPHITE**
*See also PYROLYTIC CARBON*
Material selection for TFTR limiters, 6:22921

**GRASS**
**Yields**
Production of sugarcane and tropical grasses as a renewable energy source. Third quarterly report, December 1, 1980-February 28, 1981, 6:21761 (DOE/ET/20071—T4)

**GREAT BRITAIN**
*See UNITED KINGDOM*

**GREENHOUSES**
*See also ATTACHED GREENHOUSES*
**Geothermal Space Heating**
Agriculture, greenhouse, wetland and other beneficial uses of geothermal fluids and heat, 6:21976 (CONF-810471—1)
**Waste Heat Utilization**
Optimizing power plant coolant systems, 6:21993 (CONF-8003114—)

**GRINDING MACHINES**
**Operation**
New era for ultrasonic impact grinding, 6:22422 (LA-UR—81-1316)

**GROUND SOURCE HEAT PUMPS**
**Design**
Design and field testing of solar-assisted earth coils. Final report, August 1, 1978-January 31, 1981, 6:21847 (DOE/CS/30210—T1)
**Field Tests**
Design and field testing of solar-assisted earth coils. Final report, August 1, 1978-January 31, 1981, 6:21847 (DOE/CS/30210—T1)
**Installation**
Solar-assisted heat pump field performance evaluation. Final report, 6:21859 (DOE/SF/10549—T1)
**Performance**
Second generation ground coupled solar assisted heat pump systems. Six month progress report, 6:21848 (DOE/CS/30224—T1)
Solar-assisted heat pump field performance evaluation. Final report, 6:21859 (DOE/SF/10549—T1)

**GROUND WATER**
*See also INTERSTITIAL WATER*
**Environmental Transport**
Geohydrology of Enewetak Atoll islands and reefs, 6:22726 (UCRL—85411)
**Flow Models**
Geostatistical modeling of pore velocity, 6:22725 (PNL-SA—9096)
**Mineral Cycling**
Use of carbon isotope measurements to examine the movement of labile and refractory carbon in soil, 6:22555 (CONF-8009140—)
**Quantitative Chemical Analysis**
Water: pesticides in ground water beneath irrigated farmland in Nebraska, August 1978, 6:22583
**Radiation Monitoring**
Uranium in US surface, ground, and domestic waters, 6:22597 (EPA—570/9-81-001(Vol.1))
**Sampling**
LLNL underground coal gasification project. Quarterly progress report, October-December 1980, 6:21517 (UCRL—50026-80-4)
**GROUND-WATER RESERVES**
*See AQUIFERS*
**GROUP THEORY**
**Meetings**
Group theory and its applications in physics, 1980, 6:22876
**GUANINE**
**Radiation Chemistry**
ESR study of DNA base cation radicals produced by attack of oxidizing radicals, 6:22405
**GULF COAST**
**Geology**
Problem definition study of subsidence caused by geopressured geothermal resource development, 6:21969 (LBL—12392)
**GULF GENERAL ATOMIC FAST BREEDER REACTOR**
*See GCFR REACTOR*
**GULF STREAM**
**Ecology**
Heterotrophic-photoautotrophic index: a qualitative parameter of microbial interactions applied to a Gulf Stream intrusion, 6:22655

## H

**HAEM DEHYDROGENASES**
*See CYTOCHROME OXIDASE*
**HAFNIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**HAITI**
**Energy Conservation**
Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))
**Energy Consumption**
Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))
**HALL GENERATORS**
*See MHD GENERATORS*
**HALOGEN COMPOUNDS**
**Luminescence**
Temperature dependence of the luminescence lifetimes of halopentaammine- and hexaamminerhodium(III) compounds in the solid state, 6:22384
**HAMILTON OPERATORS**
*See HAMILTONIANS*
**HAMILTONIANS**
**WKB Approximation**
WKB quantization of pseudo spin Hamiltonians, 6:22873
**HANFORD ENGINEERING DEVELOPMENT LABORATORY**
**On-Line Measurement Systems**
Automated in-line measurement of nuclear fuel pellets, 6:21708
**HARMONIC OSCILLATOR MODELS**
**Canonical Transformations**
Evolution, symmetry, and canonical structure in dynamics, 6:22868
**Equations of Motion**
Evolution, symmetry, and canonical structure in dynamics, 6:22868
**HARTREE-FOCK METHOD**
**Meetings**
Recent developments and applications of multi-configuration Hartree-Fock methods. NRCC proceedings No. 10, 6:22777 (LBL—12157)
**Wave Functions**
Super-CI MCHF program in ALCHEMY, 6:22782 (LBL—12157)
**HAWAII**
**Renewable Energy Sources**
Hawaii Natural Energy Institute annual report, 1980, 6:22108
**Wind Power**
Guidebook on wind energy-conversion applications in Hawaii, 6:21980 (HNEI—81-01)
**Wind Turbines**
Guidebook on wind energy-conversion applications in Hawaii, 6:21980 (HNEI—81-01)
**H-COAL PROCESS**
**Process Heat**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)
**HD 8077**
*See NICKEL BASE ALLOYS*
**HEALTH PHYSICS**
*See RADIATION PROTECTION*
**HEALTH PHYSICS RESEARCH REACTOR**
*See HPRR REACTOR*
**HEAT EXCHANGERS**
*See also DIRECT CONTACT HEAT EXCHANGERS*
*HEAT PUMPS*
*RADIATORS*
**Cleaning**
Test results of heat-exchanger cleaning in support of ocean thermal energy conversion, 6:21841 (DOE/CH/00135—3)
**Coatings**
Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers, 6:22029
**Defects**
Infrared techniques for the evaluation of silicon carbide heat-exchanger tubing, 6:22447
**Infrared Thermography**
Infrared techniques for the evaluation of silicon carbide heat-exchanger tubing, 6:22447
**Materials**
AR and TD fossil-energy-materials program. Quarterly progress report, October-December 1980, 6:21513 (ORNL/FMP—81/1)
**Materials Testing**
Evaluation of alloys for fuel cell heat exchangers. Final report (Texaco entrained ga[illegible]fier), 6:21511 (EPRI-EM—1815)
**HEAT FLUX**
**Numerical Solution**
Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems, 6:22446 (UCRL—85366)
**HEAT PIPES**
**Design**
Ceramic heat pipe development. Semi-annual report, 1 October 1980-31 March 1981, 6:22418 (DOE/TIC—1022096)
Heat pipe technology development, 6:22419 (LA—8797-PR)
**Fabrication**
Ceramic heat pipe development. Semi-annual report, 1 October 1980-31 March 1981, 6:22418 (DOE/TIC—1022096)
Ceramic heat exchangers: manufacturing techniques and performance, 6:22423 (LA-UR—81-1643)

Heat pipe technology development, 6:22419 (LA—8797-PR)
**Materials**
Ceramic heat exchangers: manufacturing techniques and performance, 6:22423 (LA-UR—81-1643)
**Operation**
Optimizing the heat pipe for operation in a magnetic field when liquid-metal working fluids are used, 6:22428 (UCID—19049)
**Performance**
Ceramic heat pipe development. Semi-annual report, 1 October 1980-31 March 1981, 6:22418 (DOE/TIC—1022096)
Ceramic heat exchangers: manufacturing techniques and performance, 6:22423 (LA-UR—81-1643)
Optimizing the heat pipe for operation in a magnetic field when liquid-metal working fluids are used, 6:22428 (UCID—19049)
**Performance Testing**
Heat pipe technology development, 6:22419 (LA—8797-PR)
Preliminary heat pipe testing program. Final technical report, 6:21838 (DOE/SF/10756—1)

**HEAT PUMPS**
*See also GROUND SOURCE HEAT PUMPS*
*SOLAR-ASSISTED HEAT PUMPS*
**Energy Efficiency**
Local government guide to the emerging technologies of energy-efficient motors and heat pumps. Energy technology report of the energy task force of the urban consortium, 6:22250 (DOE/IR/05106—T8)
**Operation**
Local government guide to the emerging technologies of energy-efficient motors and heat pumps. Energy technology report of the energy task force of the urban consortium, 6:22250 (DOE/IR/05106—T8)
**Parametric Analysis**
Residual energy applications program systems analysis report, 6:22241 (DOE/ET/12866—3)
**Performance**
Cooling-and-heating-load improvements in seasonal-performance modeling of room and central air conditioners and heat pumps, 6:22213 (SAI—444-80-299-LJ)
**Waste Heat Utilization**
Residual energy applications program systems analysis report, 6:22241 (DOE/ET/12866—3)

**HEAT RECOVERY EQUIPMENT**
**Fabrication**
Ceramic heat exchangers: manufacturing techniques and performance, 6:22423 (LA-UR—81-1643)
**Materials**
Ceramic heat exchangers: manufacturing techniques and performance, 6:22423 (LA-UR—81-1643)
**Operation**
Kathabar runaround energy recovery systems, 6:22235 (CONF-8003114—)
**Performance**
Ceramic heat exchangers: manufacturing techniques and performance, 6:22423 (LA-UR—81-1643)
Kathabar runaround energy recovery systems, 6:22235 (CONF-8003114—)

**HEAT TRANSFER**
*See also THERMAL CONDUCTION*
**Numerical Solution**
Consistent method for computing derived boundary quantities when the Galerkin FEM is used to solve thermal and/or fluids problems, 6:22446 (UCRL—85366)

**HEAT TRANSMISSION**
*See HEAT TRANSFER*

**HEATING LOAD**
**Calculation Methods**
Cooling-and-heating-load improvements in seasonal-performance modeling of room and central air conditioners and heat pumps, 6:22213 (SAI—444-80-299-LJ)

**HEATING OILS**
**Delivery**
State of Rhode Island No. 2 heating oil data collection program. Final report, August 27, 1979-May 22, 1980, 6:21587 (DOE/EIA/10297—T1)
**Energy Supplies**
Heating oil supply/price monitoring report: Part I. Historic data, August 1978-July 1979. Part II. Current data, August 1979-May 1980, 6:21584 (DOE/EIA/06278—T2)
State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980, 6:21586 (DOE/EIA/10221—T2)
**Inventories**
State of Rhode Island No. 2 heating oil data collection program. Final report, August 27, 1979-May 22, 1980, 6:21587 (DOE/EIA/10297—T1)
**Prices**
Heating oil supply/price monitoring report: Part I. Historic data, August 1978-July 1979. Part II. Current data, August 1979-May 1980, 6:21584 (DOE/EIA/06278—T2)
State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980, 6:21586 (DOE/EIA/10221—T2)
**Retail Prices**
Distillate price-monitoring system. Final report (Kerosene No. 1 and No. 2 home heating oil), 6:21583 (DOE/EIA/06278—T1)
Program to monitor the weekly retail price of home-heating fuel oil No. 2 in the State of New Jersey. Year one final report, 6:21585 (DOE/EIA/10169—T1)
State of Rhode Island No. 2 heating oil data collection program. Final report, August 27, 1979-May 22, 1980, 6:21587 (DOE/EIA/10297—T1)
**Supply and Demand**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
**Wholesale Prices**
State of Rhode Island No. 2 heating oil data collection program. Final report, August 27, 1979-May 22, 1980, 6:21587 (DOE/EIA/10297—T1)

**HEATING SYSTEMS**
*See also SOLAR HEATING SYSTEMS*
**Fuels**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
**Information**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))

**HEAVY ION ACCELERATORS**
**Control Systems**
Use of a small off-line computer in the operation of a versatile heavy ion cyclotron, 6:22487 (LBL—11709)

**HEAVY ION REACTIONS**
*See also ARGON 40 REACTIONS*
*KRYPTON 84 REACTIONS*
*NEON 20 REACTIONS*
**Research Programs**
Nuclear science. Annual report, July 1, 1979-June 30, 1980, 6:22844 (LBL—11588)

**HEAVY IONS**
**Beam Transport**
Numerical simulation of the transport of intense beams of heavy ions in an electrostatic quadrupole system, 6:22473 (SLAC-PUB—2673)
**Ion-Atom Collisions**
Charge transfer to the continuum by heavy ions in atomic hydrogen, 6:22769 (CONF-810432—3)

**HEDTA**
**Liquid Column Chromatography**
Determination of EDTA and HEDTA in Hanford defense waste by high-performance liquid chromatography, 6:22336 (RHO-SA—218)

**HELA CELLS**
**Hybridization**
Adenovirus type 2 expresses fiber in monkey-human hybrids and reconstructed cells, 6:22653

**HELIUM**
Doublet III neutral beam cryopumping system, 6:22932
Performance of BNL-TSTA compound cryopump, 6:22452

**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Mass Spectroscopy**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Oscillator Strengths**
Analytic representation of the dipole oscillator-strength distribution, 6:22802

**HELIUM 3 TARGET**
**Pion Minus Reactions**
Resonances in the trineutron-system, 6:22847

**HELIUM 4**
**Cosmic Nuclei**
Magnetic moment of massive neutrinos and the cosmic helium abundances, 6:22826

**HELIUM IONS**
**Energy-Level Transitions**
Are we ready to test QED in two-electron ions, 6:22757 (ANL—80-126)

**HELIUM ISOTOPES**
**Mass Spectroscopy**
Hydrogen isotope analysis by quadrupole mass spectrometry, 6:22924

**HEMATIN**
*See HEME*

**HEMATOPORPHYRIN (HEME)**
*See HEME*

**HEME**
**Electrochemistry**
Electroanalytical chemistry of (carbon monoxy)heme, 6:22392

**HEMIN**
*See HEME*

**HERPES SIMPLEX**
**Mutants**
Dependence of herpes simplex virus type 1-induced cell fusion on cell type, 6:22650

**HETEROCYCLIC COMPOUNDS**
**Gas Chromatography**
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
**Mass Spectroscopy**
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
**Mutagen Screening**
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)

**HETEROGENEOUS EFFECTS**
**Research Programs**
MIT LMFBR blanket research project. Quarterly progress report, October 1, 1980-December 31, 1980, 6:22035 (DOE/ET/37241—45)

**HEXADECANE**
**Phase Studies**
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576

**HEXANOLS**
**Adsorption**
Adsorption from selected microemulsions onto alumina (Surfactant is sodium laurate; cosurfactant is n-hexanol), 6:21579

**HFIR REACTOR**
**Reactor Operation**
High flux isotope reactor quarterly report, July, August, and September of 1980, 6:22065 (ORNL/TM—7819)

**HIGH BTU GAS**
**Production**
SNG from peat by the PEATGAS process, 6:21531
**Purification**
Acid gas removal and cryogenic separation of SNG produced from coal, 6:21512

**HIGH EXPLOSIVES**
*See CHEMICAL EXPLOSIVES*

**HIGH FLUX ISOTOPE REACTOR**
*See HFIR REACTOR*

**HIGH-FREQUENCY HEATING**
*See also ECR HEATING*
**Hybrid Resonance**
Computer simulation of lower-hybrid heating in tokamaks. Final report, 6:22877 (DOE/ER/53106—T1)
Currents generated by lower hybrid waves, 6:22882 (PPPL—1774)
Toroidal effects on propagation, damping, and linear mode conversion of lower hybrid waves, 6:22894

**HIGH-LEVEL RADIOACTIVE WASTES**
**Coatings**
Chemically vapor deposited coatings for multibarrier containment of nuclear wastes, 6:21661 (CONF-8005107—)

**HIGH-PURITY GE DETECTORS**
**Preamplifiers**
Charge sensitive preamplifier (12 Mar 1981) (Engineering Materials), 6:22509 (CAPE—2690)

**HIGH-TEMPERATURE GAS-COOLED REACTOR**
*See HTGR TYPE REACTORS*

**HIGHWAYS**
*See ROADS*

**HODOSCOPES**
**Data Acquisition Systems**
Application of parallel preprocessors in data acquisition, 6:22486 (LA-UR—81-1640)

**HOG FUEL**
*See WOOD WASTES*

**HOLLOW FUEL RODS**
**Gamma Fuel Scanning**
Gamma-ray monitor for plutonium uniformity in fuel tubes, 6:22054 (DP-MS—80-120)

**HOT WATER**
**Consumption Rates**
Hourly use profiles for solar domestic hot water heaters in the National Solar Data Network, 6:21871 (SOLAR/0005—81/80)

**HOT WATER HEATERS**
*See WATER HEATERS*

**HOT-DRY-ROCK SYSTEMS**
**Crack Propagation**
Geothermal energy: thermomechanics of heat extraction from hot, dry rock masses, 6:21974
**Heat Extraction**
When the hole is dry: the HDR alternative in the cascades, 6:21972 (LA-UR—81-1430)
**Heat Transfer**
Geothermal energy: thermomechanics of heat extraction from hot, dry rock masses, 6:21974

**HOUSEHOLDS**
**Appliances**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
**Energy Consumption**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
Pacific Northwest residential energy survey. Volume 2. Technical appendix, 6:22179 (DOE/BP—13061(Vol.2))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))

Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))

**Income**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))

**Information**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))

**Occupants**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))

**Surveys**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))

**HOUSES**

**Direct Gain Systems**
Williamson house as simulated by the DEROB system: a field validation, 6:21919

**Evaporative Cooling**
Integrating optimized evaporative cooling systems with passive homes, concepts and results, 6:22218

**Manufacturing**
Passive solar manufactured buildings program: useful model for government efforts to assist industry, 6:21900

**Passive Solar Heating Systems**
Performance summary of the Balcomb solar home, 6:21862 (LA-UR—81-1039)
Preliminary market potential indexing study of the United States for direct gain in new single-family residential construction, 6:21746 (LA-UR—81-1201)

**Photovoltaic Power Supplies**
Carlisle house: an all-solar electric residence, 6:21817 (DOE/ET/20279—133)

**Solar Air Conditioning**
Passive solar manufactured buildings program: useful model for government efforts to assist industry, 6:21900

**Solar Space Heating**
Genesis: the solar community, 6:21901
Integrating optimized evaporative cooling systems with passive homes, concepts and results, 6:22218
Passive solar manufactured buildings program: useful model for government efforts to assist industry, 6:21900
Solar energy system performance evaluation, October 1979-April 1980: Bond Construction, Gladstone, Missouri, 6:21876 (SOLAR/1050—81/14)
Solar project description for Helio-Thermics, Inc., Lot 6 single family residence; Greenville, South Carolina, 6:21874 (SOLAR/1025—81/50)
Two innovative passive air thermosiphon houses in Santa Fe, 6:21907

**Solar Water Heating**
Performance of solar energy hot water systems, 6:21868 (SOLAR/0005—81/80)
Solar energy system performance evaluation, October 1979-April 1980: Bond Construction, Gladstone, Missouri, 6:21876 (SOLAR/1050—81/14)
Solar project description for Helio-Thermics, Inc., Lot 6 single family residence; Greenville, South Carolina, 6:21874 (SOLAR/1025—81/50)

**Thermal Analysis**
Williamson house as simulated by the DEROB system: a field validation, 6:21919

**Thermal Comfort**
Index to quantify thermal comfort in homes, 6:22217

**HPRR REACTOR**

**Radiation Doses**
Nuclear accident dosimetry: Los Alamos measurements at the seventeenth nuclear accident dosimetry intercomparison study at the Oak Ridge National Lab., DOSAR Facility, August 1980, 6:22860 (LA—8799-MS)

**HTGR TYPE REACTORS**

**Cogeneration**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)

**Energy Transport**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)

**Heat Exchangers**
Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers, 6:22029

**Process Heat**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)

**Reactor Materials**
Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers, 6:22029

**Thermal Energy Storage Equipment**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)

**Uses**
Special applications of gas-cooled reactors, 6:22050 (GA-A—16262)

**HUMAN CELLS**
*See ANIMAL CELLS*

**HUMAN POPULATIONS**
**Genetic Variability**
Electrophoretic variants in three Amerindian tribes: the Baniwa, Kanamari, and central Pano of western Brazil, 6:22640
**Public Health**
Bilogical effects of ionizing radiation: epidemiological surveys and laboratory animal experiments. Implications for risk evaluation and decision processes, 6:22694 (LBL—12555)
**Radiation Protection**
Bilogical effects of ionizing radiation: epidemiological surveys and laboratory animal experiments. Implications for risk evaluation and decision processes, 6:22694 (LBL—12555)

**HUMIC ACIDS**
**Chemical Composition**
Chemical and isotopic evidence for the in situ origin of marine humic substances, 6:22578

**HYDRAULIC FRACTURES**
**Mechanical Vibrations**
Forced vibration of a fluid-filled hydraulic fracture, 6:21975

**HYDRAULIC FRACTURING**
**Stress Analysis**
Direct observation of a sand-propped hydraulic fracture, 6:21603 (SAND—81-0225)

**HYDROCARBONS**
*See also ALKANES*
*ALKYNES*
*BENZENE*
*BENZOPYRENE*
*BIPHENYL*
*CHRYSENE*
*POLYCYCLIC AROMATIC HYDROCARBONS*
*TRIPHENYLENE*
**Biosynthesis**
Hydrocarbons from plants: analytical methods and observations, 6:21805
**Formation Heat**
Heat of formation of $C_2H^+$, 6:22395
**Monitoring**
Emissions inventory for the SURE Region. Final report, 6:22545 (EPRI-EA—1913)

**HYDROCHLORIC ACID**
**Catalytic Effects**
Continuous chromatographic reactor, 6:22361

**HYDROCYANIC ACID**
**Chemical Reaction Yield**
Fundamentals of nitric oxide formation in fossil fuel combustion. Progress report, 29 June-28 September 1980, 6:22414 (DOE/ET/10593—T1)
**Oxidation**
Fundamentals of nitric oxide formation in fossil fuel combustion. Progress report, 29 June-28 September 1980, 6:22414 (DOE/ET/10593—T1)

**HYDROCYCLONES**
*See CYCLONE SEPARATORS*

**HYDROELECTRIC POWER**
Computer model for small-scale hydropower policy analysis, 6:21735
**Budgets**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Financial Data**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)

**HYDROELECTRIC POWER PLANTS**
*See also LOW-HEAD HYDROELECTRIC POWER PLANTS*
**Environmental Impact Statements**
Final environmental impact statement. McNary Lock and Dam second powerhouse, Columbia River, Oregon and Washington, 6:22599

**HYDROELECTRICITY**
*See HYDROELECTRIC POWER*

**HYDROFLUORIC ACID**
**Chemical Reactions**
Inhibition of chemical reactions by a strong laser field, 6:22365

**HYDROGEN**
Doublet III neutral beam cryopumping system, 6:22932
**Atom-Molecule Collisions**
Classical trajectory models for electronically nonadiabatic collision processes: A classical valence bond model for electronic degrees of freedom, 6:22801
Monte Carlo trajectory calculations of the energy of activation for collision-induced dissociation of $H_2$ by Ar as a function of rotational energy, 6:22794
**Chemical Reaction Kinetics**
Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)
Rockwell international gasifier--flash hydropyrolysis, 6:21523
**Chemical Reactions**
Inhibition of chemical reactions by a strong laser field, 6:22365
Molecular beam studies of atomic hydrogen reduction of refractory oxides, 6:22275 (LBL—12548)
**Chemisorption**
Hydrogen and deuterium sorption by selected rare earth intermetallic compounds at pressures up to 1500 atm, 6:22375
**Diffusion**
Hydrogen permeation characteristics of aluminum-coated and aluminum-modified steels, 6:22952
**Excited States**
Molecular resonance phenomena (Calculation of resonance widths), 6:22792 (UCRL—85858)
**Gettering**
Hydrogen isotope gettering with yttrium metal, 6:22374
**Ignition**
Strong ignition limits for methane-hydrogen mixtures, 6:21727 (LBL—12146)
**Ion-Atom Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**Melting**
Theoretical calculation of thermodynamic properties and melting curves for hydrogen and deuterium, 6:22316
**Metallurgical Effects**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)
**Oscillator Strengths**
Analytic representation of the dipole oscillator-strength distribution, 6:22802
**Photochemical Reactions**
Measurements of gas-phase reaction rates: D + HX and NO + $O_3$. Progress report, September 1, 1980-November 31, 1981, 6:22393 (DOE/ER/04426—4)
**Sorption**
Effect of hydrogen glow discharge conditioning on Zr/Al getter pumps, 6:22929
**Thermodynamic Properties**
Theoretical calculation of thermodynamic properties and melting curves for hydrogen and deuterium, 6:22316

**HYDROGEN 2**
*See DEUTERIUM*

**HYDROGEN 3**
*See TRITIUM*

**HYDROGEN CHLORIDES**
*See HYDROCHLORIC ACID*

**HYDROGEN CYANIDES**
*See HYDROCYANIC ACID*

**HYDROGEN FLUORIDES**
*See HYDROFLUORIC ACID*

**HYDROGEN FUELS**
Hydrogen-via-Electricity concept. Critique report, 6:21725 (DOE/CE—0005)
**Evaluation**
Investigation of liquid hydrogen as a vehicular fuel, 6:21724

**HYDROGEN IONS**
*See also HYDROGEN IONS 1 PLUS*

**Energy-Level Transitions**
Application of discrete basis set methods to the Dirac equation, 6:22756 (ANL—80-126)
**Lamb Shift**
Summary on experiments, 6:22768 (ANL—80-126)
**Membrane Transport**
Action of protein synthesis inhibitors in blocking electrogenic $H^+$ efflux from corn roots, 6:22663

**HYDROGEN IONS 1 PLUS**
**Ion-Atom Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**Ion-Ion Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)

**HYDROGEN ISOTOPES**
Performance of BNL-TSTA compound cryopump, 6:22452
**Mass Spectroscopy**
Hydrogen isotope analysis by quadrupole mass spectrometry, 6:22924

**HYDROGEN NITRATES**
*See NITRIC ACID*

**HYDROGEN PRODUCTION**
**Autothermal Reformer Processes**
Investigation of carbon-formation mechanisms and fuel-conversion rates in the adiabatic reformer. Annual report, March 19, 1980-March 19, 1981, 6:22161 (DOE/MC/14395—T1)
**Steam Reformer Processes**
Critical evaluation of fuel-processing technologies for fuel cells. Quarterly report, December 1, 1980-February 28, 1981, 6:22160 (DOE/ET/17103—2)
**Thermochemical Processes**
Fusion-synfuel tie producing hydrogen with the tandem mirror, 6:21723
Proposed solar-furnace study of zinc sulfate decomposition, 6:21722 (UCRL—85743)

**HYDROGEN STORAGE**
Investigation of liquid hydrogen as a vehicular fuel, 6:21724

**HYDROGEN SULFATES**
*See SULFURIC ACID*

**HYDROGEN SULFIDES**
**Pyrolysis**
Combustion diagnostics by tunable atomic line molecular spectroscopy, 6:22364 (LBL—12127)

**HYDROGENATION**
**Catalysts**
Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980, 6:21494 (DOE/ET/11429—T1)
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, December 1, 1979-February 29, 1980, 6:21500 (DOE/ET/14806—T3)
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)

**HYDROLOGY**
**Data Covariances**
The use of geostatistics in high level radioactive waste repository site characterization, 6:21688
**Flow Models**
Flux of organic carbon to the oceans: some hydrologic considerations, 6:22565 (CONF-8009140—)
**Statistical Models**
Geostatistical modeling of pore velocity, 6:22725 (PNL-SA—9096)

**HYDROXYL RADICALS**
**Chemical Reactions**
Mechanisms for radiation damage in DNA. Progress report, January 1, 1980-December 31, 1980, 6:22673 (DOE/EV/02364—T1)
Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis, 6:22408

**HYDROXYLAMINE**
**Chemical Preparation**
Kinetics of the formation of hydroxylamine disulfonate by reaction of nitrite with sulfites, 6:22366
**Photochemical Reactions**
Mass spectrometric determination of hydroxylamine photooxidation by illuminated chloroplasts, 6:22666

**HYDROXYTOLUENES**
*See CRESOLS*

**HYGAS PROCESS**
Overview of coal-gasification-materials experience in selected pilot plants, 6:21489 (CONF-810417—6)

**HYPOTHYROIDISM**
**Radioinduction**
Atrophic thyroiditis in long-term Segment III beagles, 6:22679 (FDA—81-8042)
Principal disease or cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22676 (FDA—81-8042)
Thyroid neoplasia in long-term Segment III beagles, 6:22680 (FDA—81-8042)

## I

**IAEA SAFEGUARDS**
Goals of measurement systems for international safeguards, 6:21713

**I-BEAM TYPE REACTORS**
**Beam Transport**
Generation and focusing of pulsed intense ion beams. Final progress report, April 1, 1979-September 30, 1979, 6:22909 (DOE/DP/40012—T1)
**Focusing**
Generation and focusing of pulsed intense ion beams. Final progress report, April 1, 1979-September 30, 1979, 6:22909 (DOE/DP/40012—T1)

**ICHTHYOPLANKTON**
**Entrainment**
Section 316(b) and modeling of ichthyoplankton entrainment, 6:22007 (CONF-810545—2)
**Mortality**
Section 316(b) and modeling of ichthyoplankton entrainment, 6:22007 (CONF-810545—2)

**IDAHO**
**Geology**
Preliminary geological interpretation and lithologic log of the exploratory geothermal test well (INEL-1), Idaho National Enginering Laboratory, eastern Snake River Plain, Idaho, 6:21962 (USGS-OFR—79-1248)
**Geothermal Wells**
Preliminary geological interpretation and lithologic log of the exploratory geothermal test well (INEL-1), Idaho National Enginering Laboratory, eastern Snake River Plain, Idaho, 6:21962 (USGS-OFR—79-1248)
**Households**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
**Lithology**
Preliminary geological interpretation and lithologic log of the exploratory geothermal test well (INEL-1), Idaho National Enginering Laboratory, eastern Snake River Plain, Idaho, 6:21962 (USGS-OFR—79-1248)

**Magnetic Surveys**
Aerial radiometric and magnetic survey: Driggs National Topographic Map, Idaho/Wyoming. Final report, 6:21623 (GJBX—93(81))
Aerial radiometric and magnetic survey: Pullman National Topographic Map, Idaho/Washington. Final report, 6:21628 (GJBX—117(81))
Aerial radiometric and magnetic study: Wallace National Topographic map, Idaho/Montana. Final report, 6:21626 (GJBX—111(81))
**Radiometric Surveys**
Aerial radiometric and magnetic survey: Driggs National Topographic Map, Idaho/Wyoming. Final report, 6:21623 (GJBX—93(81))
Aerial radiometric and magnetic survey: Pullman National Topographic Map, Idaho/Washington. Final report, 6:21628 (GJBX—117(81))
Aerial radiometric and magnetic study: Wallace National Topographic map, Idaho/Montana. Final report, 6:21626 (GJBX—111(81))

**IDAHO CHEMICAL PROCESSING PLANT**
**Radioactive Waste Processing**
Design and installation of a pilot-plant to vitrify ICPP-simulated calcined high-level waste, 6:21671 (ENICO—1087)

**IDAHO NATIONAL ENGINEERING LABORATORY**
**Hydrology**
Hydrologic conditions at the Idaho National Engineering Laboratory, Idaho. Emphasis: 1974-1978, 6:22594 (IDO—22060)

**IMAGE INTENSIFIERS**
Nanosecond-gating properties of proximity-focused microchannel-plate image intensifiers, 6:22520 (LA-UR—81-1126)

**IMIDAZOLES**
**Structural Chemical Analysis**
$^{15}N$ NMR study of complexation of 1-methylimidazole by zinc(II) and cadmium(II) in aqueous soltuion, 6:22389

**IMPERMEABLE DRY ROCK**
*See HOT-DRY-ROCK SYSTEMS*

**IMPURITIES**
**Quantity Ratio**
Material balance approach to estimating aquatic exposure concentrations, 6:22587
**Removal**
Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)

**INCINERATORS**
**Design**
Design and operation of a prototype incinerator for beta-gamma waste, 6:21669 (DP-MS--80-123)
**Operation**
Design and operation of a prototype incinerator for beta-gamma waste, 6:21669 (DP-MS—80-123)
**Performance**
Combustion-rate predictions for controlled-air incinerators, 6:21670 (DP-MS—81-8)

**INCOLOY ALLOYS**
**Corrosion**
Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)

**INCOMPRESSIBLE FLOW**
**Numerical Solution**
Solution of the time-dependent, three-dimensional incompressible Navier-Stokes equations via FEM, 6:22444 (UCRL—85337)
Solution of the time-dependent incompressible Navier-Stokes equations via a penalty Galerkin finite element method, 6:22445 (UCRL—85354)

**INCONEL ALLOYS**
**Corrosion**
Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)

**INDIANA**
**Black Shales**
Stratigraphic cross sections showing members of the New Albany Shale (Devonian and Mississippian) in Indiana, 6:21599 (METC/EGSP—816)

**INDIUM PHOSPHIDE SOLAR CELLS**
**Fabrication**
InP single-junction concentrator cell. Semi-annual report, October 1, 1980-March 31, 1981, 6:21790 (SERI/PR—9354-T1)
**Mathematical Models**
InP single-junction concentrator cell. Semi-annual report, October 1, 1980-March 31, 1981, 6:21790 (SERI/PR—9354-T1)

**INDIUM PHOSPHIDES**
**Crystal Growth**
InP single-junction concentrator cell. Semi-annual report, October 1, 1980-March 31, 1981, 6:21790 (SERI/PR—9354-T1)

**INDOLES**
**Liquid Column Chromatography**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**Mass Spectroscopy**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341

**INDUSTRIAL PARKS**
**Feasibility Studies**
Residual energy applications program systems analysis report, 6:22241 (DOE/ET/12866—3)
**Waste Heat Utilization**
Residual energy applications program systems analysis report, 6:22241 (DOE/ET/12866—3)

**INDUSTRIAL PLANTS**
*See also COAL GASIFICATION PLANTS*
*COAL LIQUEFACTION PLANTS*
*ETHANOL PLANTS*
*FEED MATERIALS PLANTS*
*OIL SHALE PROCESSING PLANTS*
*WASTE PROCESSING PLANTS*
**Economic Impact**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Electric Motors**
Energy conservative motors, 6:22234 (CONF-8003114—)
**Energy Conservation**
Proceedings of the energy conservation in design for UCC-ND managers and specialists, 6:22230 (CONF-8003114—)
UCC-ND energy conservation program to date, 6:22232 (CONF-8003114—)
Union Carbide Corporation: energy conservation program, 6:22231 (CONF-8003114—)
**Energy Consumption**
Union Carbide Corporation: energy conservation program, 6:22231 (CONF-8003114—)
**Heat Storage**
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)
**Site Selection**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Social Impact**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)
**Waste Heat Utilization**
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)

**INDUSTRIAL SECTOR**
*See INDUSTRY*

**INDUSTRIALIZED COUNTRIES**
*See DEVELOPED COUNTRIES*
**INDUSTRY**
*See also COAL INDUSTRY*
*CONSTRUCTION INDUSTRY*
*ELECTRIC POWER INDUSTRY*
*FOOD INDUSTRY*
*METAL INDUSTRY*
*NUCLEAR INDUSTRY*
*PETROLEUM INDUSTRY*
**Cogeneration**
Thin film battery/fuel cell power generation system. Topical report covering Task 5: the design, cost and benefit of an industrial cogeneration system, using a high-temperature solid-oxide-electrolyte (HTSOE) fuel-cell generator, 6:22159 (DOE/ET/11305—T8)
**Regulations**
Analysis of fully distributed cost pricing in regulated industries, 6:22102
Energy issues (From Mineral Economics Symposium), 6:22123
**Solar Process Heat**
Industrial process heat, 6:21916
**Thermal Insulation**
High temperature thermal insulation usage in UK process industries, 6:22245 (NP—1902598)
**INERTIAL CONFINEMENT**
Acoustic microscopy for ICF target analysis, 6:22940
**Laser Targets**
Solid-state processes to produce hemispherical components for inertial fusion targets, 6:22933
**Targets**
Metallic coating of microspheres, 6:22937
**INFORMATION THEORY**
Energy, entropy, and information, 6:22096 (CONF-8003114—)
**INHOMOGENEOUS PLASMA**
**Plasma Heating**
Irreversibility and transport in the lower hybrid drift instability, 6:22895
**INJECTION WELLS**
**Temperature Distribution**
Two-dimensional temperature distribution surrounding an injection well, 6:21573 (SAND—81-0101C)
**INPUT-OUTPUT**
*See MATERIAL BALANCE*
**INPUT-OUTPUT ANALYSIS**
*See ENERGY ANALYSIS*
**INSECTS**
**Sensitivity**
Differential life-stage susceptibility of Acheta domesticus to acridine, 6:22709
**IN-SITU COMBUSTION**
**Bench-Scale Experiments**
In-situ combustion models for the steam plateau and for fieldwide oil recovery, 6:21570 (DOE/ET/12056—11)
**Field Tests**
In-situ combustion models for the steam plateau and for fieldwide oil recovery, 6:21570 (DOE/ET/12056—11)
**IN-SITU GASIFICATION**
**Bench-Scale Experiments**
LLNL underground coal gasification project. Quarterly progress report, October-December 1980, 6:21517 (UCRL—50026-80-4)
**Commercialization**
Outlook for in situ gasification of eastern coal, 6:21522
**Field Tests**
Geotechnical studies related to in situ lignite-gasification trials. Semi-annual technical report, October 1, 1980-March 31, 1981, 6:21506 (DOE/PC/30221—T1)
**Mathematical Models**
LLNL underground coal gasification project. Quarterly progress report, October-December 1980, 6:21517 (UCRL—50026-80-4)
**Planning**
LLNL underground coal gasification project. Quarterly progress report, October-December 1980, 6:21517 (UCRL—50026-80-4)
**Research Programs**
Outlook for in situ gasification of eastern coal, 6:21522
**IN-SITU RETORTING**
**Temperature Measurement**
Ultrasonic thermometry in oil shale retorts, 6:21612 (UCRL—85845)
**INSOLATION**
*See also SOLAR FLUX*
**Data Compilation**
April 1981 environmental data for sites in the National Solar Data Network, 6:21741 (SOLAR/0010—81/04)
**Mathematical Models**
Solar radiation modeling and comparisons with current solar radiation models, 6:21744
**Ultraviolet Radiation**
Actinometric measurement of solar ultraviolet, 6:21742
**INSULATION (THERMAL)**
*See THERMAL INSULATION*
**INTEGRATED CIRCUITS**
**Electric Conductivity**
Discussion of the role of distributed effects in latch-up, 6:22456 (SAND—81-0658C)
**Operation**
Discussion of the role of distributed effects in latch-up, 6:22456 (SAND—81-0658C)
**Reliability**
Discussion of the role of distributed effects in latch-up, 6:22456 (SAND—81-0658C)
**INTEGRATED UTILITY SYSTEMS**
*See TOTAL ENERGY SYSTEMS*
**INTENSIFIERS (IMAGE)**
*See IMAGE INTENSIFIERS*
**INTERCONNECTED POWER SYSTEMS**
**Load Analysis**
Algebraic aggregation of interconnected power system loads, 6:22020
**Photovoltaic Power Supplies**
Residential photovoltaic system designs, 6:21814 (DOE/ET/20279—123)
Residential photovoltaic power systems for the northeast, 6:21816 (DOE/ET/20279—132)
**INTERMEDIATE BTU GAS**
**Cost**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)
**INTERMEDIATE TECHNOLOGY**
*See APPROPRIATE TECHNOLOGY*
**INTERNAL COMBUSTION ENGINES**
*See also DIESEL ENGINES*
**Combustion Chambers**
Experimental investigation into the application of spontaneous Raman scattering to spray measurements in an engine, 6:22259 (SAND—81-8642)
**Deposits**
Chemical physics of catalysis. Residium upgrading and coking. Chemistry of engine combustion deposits, 6:21582
**Liquid Fuels**
Experimental investigation into the application of spontaneous Raman scattering to spray measurements in an engine, 6:22259 (SAND—81-8642)
**INTERSTITIAL WATER**
**Sampling**
Interstitial water chemistry: Deep Sea Drilling Project, Leg 11, 6:22579
Interstitial water chemistry: Deep Sea Drilling Project, Leg 14, 6:22580
**Water Chemistry**
Early diagenesis in a reducing fjord, Saanich Inlet, British Columbia. I. Chemical and isotopic changes in major components of interstitial water, 6:22574
Early diagenesis in a reduced fjord, Saanish Inlet, British Columbia. III. Changes in organic constituents of sediment, 6:22581
Interstitial water chemistry: Deep Sea Drilling Project, Leg 11, 6:22579

Interstitial water chemistry, Leg 12, 6:22576
Interstitial water chemistry: Deep Sea Drilling Project, Leg 14, 6:22580
Interstitial water chemistry: Deep Sea Drilling Project, Leg 10, 6:22577
pH buffering of pore water of recent anoxic marine sediments, 6:22575

**INTESTINAL ABSORPTION**
**Biochemical Reaction Kinetics**
Intestinal transport: studies with isolated epithelial cells, 6:22625

**INTOR TOKAMAK**
**High-Frequency Heating**
Computer simulation of lower-hybrid heating in tokamaks. Final report, 6:22877 (DOE/ER/53106—T1)

**INVENTORIES**
**Validation**
Inventory verification methods in DOE safeguards inspections, 6:21704

**IODINE**
**Chemical Vapor Deposition**
In situ seeding of high Z elements with glow discharge polymerized organic coatings, 6:22944
**Corrosive Effects**
Stress corrosion cracking of zircaloy by metal iodides and cadmium, 6:22274 (LBL—12548)

**IODINE 125**
**Labelled Compounds**
Variants of 3T3 cells lacking mitogenic response to the tumor promoter tetradecanoyl-phorbol-acetate, 6:22632

**IODINE 129**
**Fluorescence Spectroscopy**
Detection of iodine-129 by laser-induced fluorescence spectrometry, 6:22342
**Laser Spectroscopy**
Detection of iodine-129 by laser-induced fluorescence spectrometry, 6:22342

**ION BEAM TYPE REACTORS**
*See I-BEAM TYPE REACTORS*

**ION BEAMS**
*See also LITHIUM 6 BEAMS*
**Beam Neutralization**
Method of active charge and current neutralization of intense ion beams for ICF, 6:22917 (LA-UR—81-1408)
**Energy Spectra**
Metallic wedge degraders for rapid energy measurement of Bevalac heavy ion beams, 6:22469 (LBL—11726)
**Getters**
Nonevaporable getter for ion beam fusion, 6:22930
**Neutron Flux**
Ion beam characteristics of a gas-filled accelerator tube, 6:22809
**Vacuum Pumps**
Nonevaporable getter for ion beam fusion, 6:22930

**ION EXCHANGE CHROMATOGRAPHY**
**Automation**
Automated ion-exchange system for the rapid separation of plutonium from impurities in safeguards analyses, 6:22359

**ION EXCHANGE MATERIALS**
**Radiolysis**
Effects of ionizing radiation on perfluorosulfonic acid ion-exchange polymer (Nafion), 6:22308

**ION MICROPROBE ANALYSIS**
**Performance**
Nuclear microprobe analysis, 6:22787 (SAND—81-0203C)
**Sensitivity**
Nuclear microprobe analysis, 6:22787 (SAND—81-0203C)

**ION PLASMA WAVES**
**Ion Sources**
Spontaneous ion-acoustic generation in a high power, multifilament ion source, 6:22889

**ION SOURCES**
**Research Programs**
Microwave plasma source for neutral-beam injection systems. Quarterly technical progress report, 6:22911 (DOE/ER/52071—T1)

**ION-ATOM COLLISIONS**
**Charge Exchange**
Atomic physics of strongly correlated systems, 6:22770 (CONF-810432—4)
Charge transfer to the continuum by heavy ions in atomic hydrogen, 6:22769 (CONF-810432—3)
**Electron Capture**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**Target Chambers**
Charge transfer to the continuum by heavy ions in atomic hydrogen, 6:22769 (CONF-810432—3)

**ION-ION COLLISIONS**
**Electron Capture**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)

**IONIZATION CALORIMETERS**
*See SHOWER COUNTERS*

**IONIZATION CHAMBERS**
**Accuracy**
Examination of LWR irradiated fuel assemblies using simple ion chamber techniques, 6:22056

**IONIZATION GAGES**
**Sensitivity**
Nitrogen sensitivities of a sample of commercial hot cathode ionization gage tubes, 6:22449

**IONIZING RADIATIONS**
**Biological Radiation Effects**
Bilogical effects of ionizing radiation: epidemiological surveys and laboratory animal experiments. Implications for risk evaluation and decision processes, 6:22694 (LBL—12555)
**Interactions**
Interactions of radiation and chemical carcinogens, 6:22700
**Mutagenesis**
Of mice and mutagens, 6:22697
**Risk Assessment**
Bilogical effects of ionizing radiation: epidemiological surveys and laboratory animal experiments. Implications for risk evaluation and decision processes, 6:22694 (LBL—12555)

**IONOPHORESIS**
*See ELECTROPHORESIS*

**IONOSPHERE**
**Barium**
Occultation of the ATS-3 satellite by the AVEFRIA barium ion cloud, 6:22743 (CONF-810421—3)
**Barium Ions**
Description of the barium cloud vectoring systems developed for the PLACES test series, 6:22745 (SAND—81-0483)
**High-Frequency Heating**
SPS ionosphere/microwave beam interactions: Arecibo experimental studies, 6:21752 (LA-UR—80-3095)
**Wave Propagation**
Occultation of the ATS-3 satellite by the AVEFRIA barium ion cloud, 6:22743 (CONF-810421—3)
**Wind**
Description of the wind profile system developed for the PLACES test series, 6:22744 (SAND—81-0482)

**IRIDIUM COMPLEXES**
**Structural Chemical Analysis**
Alkyl-metal and aryl-metal bond chemistry in coordinately unsaturated polynuclear metal complexes, 6:22371

**IRON**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Energy Levels**
State-of-the-art for multiconfiguration Dirac-Fock calculations, 6:22753 (ANL—80-126)
**Liquid Column Chromatography**
Determination of EDTA and HEDTA in Hanford defense waste by high-performance liquid chromatography, 6:22336 (RHO-SA—218)

**IRON ALLOYS**
**Electrodeposition**
Galvanic deposition of superinvar alloys, 6:22293 (UCRL-Trans—11676)
**IRON BORIDES**
**Physical Radiation Effects**
Comments on '30 K fast neutron and fission fragment irradiations of two Fe-B type amorphous alloys', 6:22304
**IRON CHLORIDES**
**Radiosensitivity Effects**
Irradiation of microorganism such as bacteria and viruses in the presence of chemical enhancing agent, 6:22696
**IRON COMPLEXES**
**Electrochemistry**
Electroanalytical chemistry of (carbon monoxy)heme, 6:22392
**Photolysis**
Laser-flash-induced dissociation and recombination of aqueous pentacyano (2-methylpyrazine)ferrate(II) ion, 6:22396
**Recombination**
Laser-flash-induced dissociation and recombination of aqueous pentacyano (2-methylpyrazine)ferrate(II) ion, 6:22396
**IRON COMPOUNDS**
**Auger Effect**
Analysis of transition metal carbonyl Auger line shapes, 6:22322
**Electron Spin Resonance**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)
**IRON IODIDES**
**Corrosive Effects**
Stress corrosion cracking of zircaloy by metal iodides and cadmium, 6:22274 (LBL—12548)
**IRON IONS**
**Energy Levels**
Correlation corrections to energy levels of Fe XXI, 6:22760 (ANL—80-126)
**Energy-Level Transitions**
Beam-foil observation of $1s2s^3S$ - $1s2p^3P$ transitions in helium-like $Fe^{24+}$, 6:22764 (ANL—80-126)
**Ion Spectroscopy**
Beam-foil observation of $1s2s^3S$ - $1s2p^3P$ transitions in helium-like $Fe^{24+}$, 6:22764 (ANL—80-126)
**Ion-Atom Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**Ion-Ion Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**IRON NITRIDES**
**Microstructure**
Moessbauer characterization of reactively sputtered iron nitride films, 6:22303
**Moessbauer Effect**
Moessbauer characterization of reactively sputtered iron nitride films, 6:22303
**Sputtering**
Moessbauer characterization of reactively sputtered iron nitride films, 6:22303
**X-Ray Diffraction**
Moessbauer characterization of reactively sputtered iron nitride films, 6:22303
**IRON OXIDES**
*See also MAGNETITE*
**Electron Microscopy**
Particle size determination in supported $\alpha$-$Fe_2O_3$, 6:22370
**Moessbauer Effect**
Particle size determination in supported $\alpha$-$Fe_2O_3$, 6:22370
**Particle Size**
Particle size determination in supported $\alpha$-$Fe_2O_3$, 6:22370
**X-Ray Diffraction**
Particle size determination in supported $\alpha$-$Fe_2O_3$, 6:22370
**IRON SULFIDES**
*See also PYRITE*
*PYRRHOTITE*
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581
**IRRADIATION REACTORS**
*(For isotope production and irradiation purposes; for producing fissile materials see PRODUCTION REACTORS.)*
**Specifications**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Tables**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**ISABELLE STORAGE RINGS**
**Magnetic Spectrometers**
Toroidal magnetic detector, 6:22483 (DOE/ER/03072—1)
**On-Line Control Systems**
RELWAY: a process data highway system optimized for accelerators, 6:22481 (BNL—29243)
**Vacuum Systems**
Evaluation of ISABELLE full cell ultrahigh vacuum system, 6:22507
Selection and evaluation of an ultrahigh vacuum gate valve for ISABELLE beam line vacuum system, 6:22450
**ISOELECTRONIC ATOMS**
**Dipole Moments**
Cancellations in atomic dipole transition moments in the Cu isoelectronic sequence, 6:22346
**ISOMERIZATION**
*See CHEMICAL REACTIONS*
**ISOMERS**
*(Only for geometrical isomers and stereoisomers in chemistry; see also ISOMERIC NUCLEI.)*
**Latent Heat Storage**
Energy storage in organic photoisomers, 6:21809
**ITALY**
**Vapor-Dominated Systems**
Performance matching and prediction for Serrazzano geothermal reservoir by means of numerical simulation, 6:21960 (LBL—12174)
**IUS**
*See TOTAL ENERGY SYSTEMS*

## J

**JAILS**
*See PUBLIC BUILDINGS*
**JAPAN**
**Pollution Regulations**
Role of biodegradability in the environmental evaluation of polychlorinated biphenyls and chemicals in general, 6:22600
**JET ENGINE FUELS**
**Chemical Composition**
Hydrocarbon type analysis of jet fuels by $^1H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)

## K

**KANSAS**
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**KEROGEN**
**Conversion**
Alkanes obtained by thermal conversion of Green River oil-shale kerogen using CO and H/sub 2/O at elevated pressure, 6:21614
**KEROSENE**
**Energy Supplies**
State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980, 6:21586 (DOE/EIA/10221—T2)

**Prices**
State of Connecticut middle data collection program. Final report, August 1, 1979-May 31, 1980, 6:21586 (DOE/EIA/10221—T2)
**Retail Prices**
Distillate price-monitoring system. Final report (Kerosene No. 1 and No. 2 home heating oil), 6:21583 (DOE/EIA/06278—T1)
**KETONES**
**Photochemistry**
Triplet energy migration in polymer photochemistry. A model for the photodegradation of poly(phenyl vinyl ketone) in solution, 6:22403
**Photolysis**
ESR study of electron reactions with carboxylic acids, ketones, and aldehydes in aqueous glasses, 6:22399
**Reduction**
Mild and convenient conversion of ketones to the corresponding methylene derivatives via reduction of tosylhydrazones by bis(benzoyloxy)borane, 6:22386
**Stereochemistry**
Restricted rotation in hydroxyphenyl ketones and formaldehydes, 6:22385
**KIDNEYS**
**Biological Radiation Effects**
Renal alterations in Segment II and III perinatally irradiated beagles, 6:22691 (FDA—81-8042)
Renal function changes associated with aging and ionizing radiation: a summary, 6:22693 (FDA—81-8042)
**Urogenital System Diseases**
Renal alterations in Segment II and III perinatally irradiated beagles, 6:22691 (FDA—81-8042)
**KLYSTRONS**
**Monitoring**
Pulse to pulse klystron diagnosis system, 6:22502 (SLAC-PUB—2702)
**KNOCK-ON ELECTRONS**
*See ELECTRONS*
**KOPPERS-TOTZEK PROCESS**
**Comparative Evaluations**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)
**KRYPTON 84 REACTIONS**
**Deep Inelastic Scattering**
Rigid rotation and l-wave fractionation in the deep-inelastic reaction: 664 MeV $^{84}$Kr+/sup nat/Ag, 6:22851
**Fragmentation**
Rigid rotation and l-wave fractionation in the deep-inelastic reaction: 664 MeV $^{84}$Kr+/sup nat/Ag, 6:22851
**KRYPTON IONS**
**Collisions**
Laser fluorescence spectroscopy of sputtered zirconium atoms, 6:22803
**Dissociation Energy**
Geometry and spectral properties of $Ne^{+}_{3}$, $Ar^{+}_{3}$, $Kr^{+}_{3}$, and $Xe^{+}_{3}$, 6:22793
**KRYPTON OXIDES**
**Emission Spectra**
Matrix interactions with rare-gas oxide excimers, 6:22747
**Photoluminescence**
Matrix interactions with rare-gas oxide excimers, 6:22747

## L

**L-2 STELLARATOR**
**Beta Ratio**
Limiting beta of stellarators with no net current, 6:22897
**Equilibrium**
Limiting beta of stellarators with no net current, 6:22897
**LAKE MICHIGAN**
**Air Quality**
Comparison between polluted and clean air masses over Lake Michigan, 6:22549
**LAMBDA-2250 RESONANCES**
**Photoproduction**
Photoproduction of charmed baryons, 6:22820
**Rest Mass**
Photoproduction of charmed baryons, 6:22820
**LAMINOGRAPHY**
*See TOMOGRAPHY*
**LAMPF LINAC**
**Data Acquisition Systems**
Application of parallel preprocessors in data acquisition, 6:22486 (LA-UR—81-1640)
**Remote Handling Equipment**
Torus sector handling system, 6:22485 (LA-UR—81-1324)
**LAND USE**
**Planning**
Energy conservation through site planning: a systems approach, 6:22557 (CONF-810531—1)
**LANDFILLS**
*See SANITARY LANDFILLS*
**LANGUAGES (PROGRAMMING)**
*See PROGRAMMING LANGUAGES*
**LANTHANIDES**
*See RARE EARTHS*
**LANTHANUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**LANTHANUM CHROMITES**
*See CHROMIUM OXIDES*
**LANTHANUM HYDRIDES**
**Phase Studies**
Isotope effects in the lanthanum dihydrides, 6:22368
**LANTHANUM PHOSPHATES**
**Pelletizing**
Hot and cold pressing of $(La,Ce)PO_4$-based nuclear waste forms, 6:21658 (CONF-8005107—)
**LANTHANUM PHOSPHIDES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**LASER CAVITIES**
**Absorption**
Alternate model of CW dye laser intracavity absorption, 6:22440
**LASER FUSION REACTORS**
**Economic Analysis**
Economic impact of a laser-fusion breeder on the U.S. energy economy, 6:22910
**Laser Targets**
Metal coatings for laser fusion targets by electroplating, 6:22939
**LASER RADIATION**
**Reflection**
In-situ optical breakdown: studies for a large $CO_2$ laser amplifier, 6:22914 (LA-UR—81-1245)
**Spectroscopy**
Photothermal deflection spectroscopy and detection, 6:22439
**LASER SPECTROSCOPY**
Effect of propagation of coherent pulses on multiple-photon excitation, 6:22789 (UCRL—83764)
**LASER TARGETS**
**Ablation**
Stationary flow model of ablatively imploded spherical shells, 6:22907 (DOE/DP/40003—T1)
Structure and observable characteristics of laser driven ablation, 6:22906 (DOE/DP/40003—T1)
**Cleaning**
Cleaning procedure for inertial fusion targets, 6:22936

**Coatings**
Metallic and nonmetallic coatings for ICF targets, 6:21720 (UCRL—85140)
Plastic coating of microsphere substrates, 6:22941
Ultrasmooth plasma polymerized coatings for laser-fusion targets, 6:21719 (UCRL—84475(Rev.1))
**Electroplating**
Metal coatings for laser fusion targets by electroplating, 6:22939
**Fabrication**
Double-shell inertial confinement fusion target fabrication, 6:22934
Solid-state processes to produce hemispherical components for inertial fusion targets, 6:22933
**Heat Flow**
Structure and observable characteristics of laser driven ablation, 6:22906 (DOE/DP/40003—T1)
**Mathematical Models**
Theoretical studies of plasma turbulence and hydrodynamic instability in fusion targets, 6:22905 (DOE/DP/40003—T1)
**Rayleigh-Taylor Instability**
Taylor instability in fusion targets, 6:22908 (DOE/DP/40003—T1)
**Vacuum Coating**
In situ seeding of high Z elements with glow discharge polymerized organic coatings, 6:22944
**Vapor Deposited Coatings**
Metal coatings for laser fusion targets by electroplating, 6:22939

**LASER-PRODUCED PLASMA**
**Heat Flow**
Structure and observable characteristics of laser driven ablation, 6:22906 (DOE/DP/40003—T1)
**Plasma Diagnostics**
Optical diagnostics of $CO_2$ laser-fusion targets using backscattered light, 6:22881 (LA-UR—81-1435)

**LASER-RADIATION HEATING**
**Brillouin Effect**
Spectroscopic study of stimulated Brillouin scattering, 6:22896

**LASERS**
*See also CARBON DIOXIDE LASERS*
*DYE LASERS*
*NEODYMIUM LASERS*
*SOLID STATE LASERS*
Laser damage testing of coated reflectors at excimer laser wavelengths, 6:22436 (LA-UR—81-1567)
**Beam Monitoring**
Spatial mapping of concentrations in pulsed and continuous atom sources, 6:22401
**Far Infrared Radiation**
Unidirectional, pulsed far-infrared ring laser, 6:22437
**Pulses**
Unidirectional, pulsed far-infrared ring laser, 6:22437

**LATENT HEAT STORAGE**
**Feasibility Studies**
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)

**LATTICE FIELD THEORY**
**Axial-Vector Currents**
Axial-vector anomaly in lattice gauge theory, 6:22829
**Gauge Invariance**
Axial-vector anomaly in lattice gauge theory, 6:22829
Relationship between lattice and continuum definitions of the gauge-theory coupling, 6:22840
**Research Programs**
Theoretical high energy physics. Progress report, May 1, 1980-April 30, 1981, 6:22835 (DOE/ER/02271—T2)

**LATTICES (CRYSTAL)**
*See CRYSTAL LATTICES*

**LAWRENCE BERKELEY LABORATORY**
**Research Programs**
Applied battery and electrochemical research program report for fiscal year 1980, 6:22092 (LBL—12514)
Nuclear science. Annual report, July 1, 1979-June 30, 1980, 6:22844 (LBL—11588)

**LAWRENCIUM**
**Chemistry**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:22413

**LEACHATES**
**Chemical Composition**
Coal conversion solid wastes: characterization for environmental assessment, 6:21515 (ORNL/TM—7533)

**LEACHING**
**Cost**
Multistage leaching of spent modified in situ oil shale retorts, 6:21609 (LA—8744-MS)

**LEAD**
**Absorption Spectroscopy**
Portland $1^0$ x $2^0$ NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Argon 40 Reactions**
Exploratory studies on relativistic heavy-ion central collisions, 6:22819

**LEAD-ACID BATTERIES**
**Design**
Development of a totally maintenance-free, deep-discharge lead-acid battery for photovoltaic applications, 6:22095 (SAND—81-7119C)
**Fabrication**
Development of a totally maintenance-free, deep-discharge lead-acid battery for photovoltaic applications, 6:22095 (SAND—81-7119C)
**Performance**
Operational experiences in lead-acid batteries for photovoltaic systems, 6:21813 (DOE/ET/20279—118)
**Performance Testing**
Development of a totally maintenance-free, deep-discharge lead-acid battery for photovoltaic applications, 6:22095 (SAND—81-7119C)

**LEASES**
**Environmental Impact Statements**
United States Depratment of the Interior final environmental impact statement, 6:21590

**LENS (CRYSTALLINE)**
*See CRYSTALLINE LENS*

**LEPTON-HADRON INTERACTIONS**
**Scattering Amplitudes**
Intuitive approach to a generalized parton picture for high-energy lepton—hadron scattering, 6:22831

**LEUKOCYTES**
*See also LYMPHOCYTES*
**Biological Radiation Effects**
Effect of cytosine arabinoside on the frequency of x-ray-induced chromosome aberrations in normal human leukocytes, 6:22699

**LIDAR**
*See OPTICAL RADAR*

**LIFE-CYCLE COST**
**Calculation Methods**
Life cycle cost analysis, 6:22116 (CONF-8003114—)
**Reviews**
Life cycle cost analysis, 6:22116 (CONF-8003114—)

**LIGASES**
**Biochemical Reaction Kinetics**
HeLa cell DNA polymerase $\alpha$ is tightly associated with tryptophanyl-tRNA synthetase and diadenosine 5′,5‴-$P^1$,$P^4$-tetraphosphate binding activities, 6:22614

**LIGHT WATER BREEDER REACTORS**
*See LWBR TYPE REACTORS*

**LIGHTING SYSTEMS**
**Energy Efficiency**
Energy-conservation opportunities in lighting, 6:22191 (DOE/CE/60467—02)

**LIGNITE**
**Ashes**
Low-rank coal study : national needs for resource development. Volume 2. Resource characterization, 6:21543 (DOE/FC/10066—T1(Vol.2))

**Calorific Value**
Low-rank coal study : national needs for resource development. Volume 2. Resource characterization, 6:21543 (DOE/FC/10066—T1(Vol.2))
**Combustion Properties**
Pilot plant tests of peat for direct combustion in utility boilers, 6:21563
**Market**
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))

**LIMITERS**
**Materials Testing**
Material selection for TFTR limiters, 6:22921

**LINACS**
*See LINEAR ACCELERATORS*

**LINEAR ACCELERATORS**
*See also FMIT LINAC*
*LAMPF LINAC*
*STANFORD 20-GEV LINAC*
*SUPERHILAC*
**Beam Dynamics**
Particle dynamics in linear resonance accelerators, 6:22480 (LA-tr—80-10)
**Colliding Beams**
Prospects for very-high-gradient linac-colliders, 6:22498 (SLAC-PUB—2689)
**Feasibility Studies**
Prospects for very-high-gradient linac-colliders, 6:22498 (SLAC-PUB—2689)
**On-Line Control Systems**
Applicability of the FASTBUS standard to distributed control, 6:22503 (SLAC-PUB—2703)
**Pulse Techniques**
Overview of the ETA/ATA pulse power, 6:22505 (UCRL—83993)
**Uses**
Design study for a high-current, steady-state auto-resonant accelerator. Addendum to final report, July 14, 1979-November 14, 1979, 6:22484 (DOE/ER/05911—T1)

**LIQUEFIED NATURAL GAS**
**Gas Spills**
Computer modeling of massive LNG spills from storage tanks at Point Conception, Oxnard, and Los Angeles Harbor, California, 6:21601

**LIQUID FUELS**
**Emergency Plans**
Liquid fuel conservation: an opportunity for local governments, 6:22223
**Evaporation**
Experimental investigation into the application of spontaneous Raman scattering to spray measurements in an engine, 6:22259 (SAND—81-8642)
**Resource Conservation**
Liquid fuel conservation: an opportunity for local governments, 6:22223

**LIQUID METAL FAST BREEDER REACTORS**
*See LMFBR TYPE REACTORS*

**LIQUID METAL TEST FACILITIES**
*See TEST FACILITIES*

**LIQUID METALS**
**Pressure Drop**
Optimizing the heat pipe for operation in a magnetic field when liquid-metal working fluids are used, 6:22428 (UCID—19049)

**LIQUIDS**
*See also LIQUID METALS*
**Dielectric Properties**
Frequency-dependent dielectric response in polar liquids, 6:22816
**Diffusion**
Theory of the Stern—Volmer coefficient for dense fluids, 6:22812
**Fluorescence**
Theory of the Stern—Volmer coefficient for dense fluids, 6:22812
**Radiationless Decay**
Theory of the Stern—Volmer coefficient for dense fluids, 6:22812

**LITEK LAMP**
*See FLUORESCENT LAMPS*

**LITHIUM**
**Chemical Reactions**
Inhibition of chemical reactions by a strong laser field, 6:22365
**Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Emission Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Oscillator Strengths**
Analytic representation of the dipole oscillator-strength distribution, 6:22802
**Passivity**
Electrochemical studies of the film formation on lithium in propylene carbonate solutions under open circuit conditions, 6:22090 (LBL—12102)
**Protective Coatings**
Electrochemical studies of the film formation on lithium in propylene carbonate solutions under open circuit conditions, 6:22090 (LBL—12102)

**LITHIUM 6 BEAMS**
**Spin Orientation**
Studies on a high-grade polarized lithium-6 target, 6:22506 (ANL-Trans—1195)

**LITHIUM 6 TARGET**
**Deuteron Reactions**
Studies on a high-grade polarized lithium-6 target, 6:22506 (ANL-Trans—1195)
**Polarized Targets**
Studies on a high-grade polarized lithium-6 target, 6:22506 (ANL-Trans—1195)

**LITHIUM BROMIDES**
**Physical Properties**
Proprties of the Carrol system and a machine design for solar-powered, air-cooled, absorption space cooling. Phase I and Phase II. Final report, September 1977-March 1979, 6:21851 (DOE/CS/31587—T2)

**LITHIUM HYDRIDES**
**Interatomic Forces**
Molecular potentials and relaxation dynamics, 6:22790 (UCRL—85577)
Molecular potentials and relaxation dynamics, 6:22791 (UCRL—85577(Rev.1))

**LIVER**
**Biological Functions**
Bioindicators of the health of arctic foxes (Alopex lagopus), 6:22660 (PNL-SA—9197)
**Natural Radioactivity**
Development of some natural matrix standards - progress report, 6:22331
**Pathological Changes**
Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age, 6:22677 (FDA—81-8042)
**Sample Preparation**
Development of some natural matrix standards - progress report, 6:22331

**LIXIVIATION**
*See LEACHING*

**LMFBR TYPE REACTORS**
*See also CLINCH RIVER BREEDER REACTOR*
*EBR-2 REACTOR*
**Breeding Blankets**
MIT LMFBR blanket research project. Quarterly progress report, October 1, 1980-December 31, 1980, 6:22035 (DOE/ET/37241—45)
**Comparative Evaluations**
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**Fuel Assemblies**
Sodium natural convection testing in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility, 6:22072 (CONF-810553—1)

**Fuel Pins**
Irradiated mixed-oxide-fuel and fission-gas-release behavior during ex-reactor thermal-transient tests, 6:22036 (HEDL-SA—2175)
**Primary Coolant Circuits**
Experimental benchmark for piping system dynamic-response analyses, 6:22032 (CONF-810625—13)
**Reactor Accidents**
Sodium natural convection testing in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility, 6:22072 (CONF-810553—1)
**Reactor Cooling Systems**
Comparison of LMFBR piping response obtained using response spectrum and time history methods, 6:22073 (CONF-810625—15)
**Reactor Physics**
BOLD VENTURE COMPUTATION SYSTEM for nuclear reactor core analysis, Version III, 6:22038 (ORNL—5711)
**Reactor Safety**
Fast reactor safety program. Progress report, January-March 1980, 6:22066 (ANL/TMC—80-3)
**Seismic Effects**
Comparison of LMFBR piping response obtained using response spectrum and time history methods, 6:22073 (CONF-810625—15)

**LNG**
*See LIQUEFIED NATURAL GAS*

**LOAD MANAGEMENT**
**Research Programs**
Energy Management and Utilization Division (Report section), 6:22137 (EPRI-P—1726-SR)

**LOCAL GOVERNMENT**
Capturing the sun's energy: opportunities for local governments, 6:21750
**Energy Management**
Energy management workbook for local governments. Workbook 1: electrical energy, 6:22117 (DOE/BP—32)
Guide to reducing energy use...budget costs. Volume II. Local energy management program, 6:22248 (DOE/CS/60419—T1)
Municipal energy conservation manual, 6:22252 (DOE/TIC—1021874)
Municipal Energy Management Program (MEMP), 6:22118
**Resource Conservation**
Liquid fuel conservation: an opportunity for local governments, 6:22223

**LOGGING WHILE DRILLING**
*See MWD SYSTEMS*

**LONGWALL MINING**
**Research Programs**
The US Department of Energy's coal mining research, 6:21554

**LOS ALAMOS MESON PHYSICS FACILITY**
*See LAMPF LINAC*

**LOSS OF COOLANT**
Nuclear fuel rod stored-energy uncertainty analysis: a study of error propagation in complicated models, 6:22068 (CONF-791016—)
**Cavitation**
Some factors affecting the metering of subcooled water with a choked venturi, 6:22071 (CONF-810406—4)
**Heat Transfer**
Heat transfer in vertical countercurrent steam-water flooding flows (PWR), 6:22084
**Shock Waves**
Method for chug classification, 6:22083 (UCRL—85707)
**Two-Phase Flow**
Heat transfer in vertical countercurrent steam-water flooding flows (PWR), 6:22084

**LOW BTU GAS**
**Production**
Gasifiers in industry: experiences on the first few projects., 6:21530

**LOW DOSE IRRADIATION**
**Risk Assessment**
General statistical data structure for epidemiologic studies of DOE workers, 6:22671 (CONF-801045—)

**LOW-HEAD HYDROELECTRIC POWER PLANTS**
**Computerized Simulation**
Computer model for small-scale hydropower policy analysis, 6:21735

**LUBRICATING OILS**
**Comparative Evaluations**
Design and testing of a procedure for evaluating fuel-efficient crankcase lubricants, 6:21592 (DOE/BETC/RI—81/2)
**Fuel Economy**
Design and testing of a procedure for evaluating fuel-efficient crankcase lubricants, 6:21592 (DOE/BETC/RI—81/2)

**LUNAR MATERIALS**
**Carbon 14**
Carbon and carbon-14 in lunar soil 14163, 6:22737 (BNL—29527)

**LUNG CELLS**
*See RESPIRATORY TRACT CELLS*

**LUNG CLEARANCE**
Retention of microspheres in the rat lung after intratracheal instillation, 6:22706

**LUNGS**
**Natural Radioactivity**
Development of some natural matrix standards - progress report, 6:22331
**Pathological Changes**
Pathologic changes associated with experimental exposure of rats to coal dust, 6:22707
**Sample Preparation**
Development of some natural matrix standards - progress report, 6:22331
**Sensitivity**
Effect of lung damage by acute exposure to nitrogen dioxide on lung immunity in the rat, 6:22708

**LURGI PROCESS**
**Comparative Evaluations**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)

**LURGI SLAGGING PROCESS**
**Performance Testing**
Gasification of caking coals in the BGC/Lurgi slagging gasifier--a status report., 6:21534

**LUTETIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))

**LWBR TYPE REACTORS**
**Reactor Cores**
Summary of the hydraulic evaluation of LWBR (LWBR development program), 6:22042 (WAPD-TM—1386)
Summary of the thermal evaluation of LWBR (LWBR Development Program), 6:22041 (WAPD-TM—1385)

**LYMPHOBLASTOMAS**
*See LYMPHOMAS*

**LYMPHOCYTES**
**Sensitivity**
Alterations of two-dimensional electrophoretic maps in human peripheral blood lymphocytes induced by concanavalin A, 6:22711
**Tissue Distribution**
Distribution of T and B lymphocytes in blood and lymphoid tissues of fetal and adult sheep, 6:22634

**LYMPHOGRANULOMAS**
*See LYMPHOMAS*

**LYMPHOID CELLS**
*See LYMPHOCYTES*

**LYMPHOMAS**
**Radioinduction**
Malignancy as a cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22678 (FDA—81-8042)
Malignant lymphomas in beagles exposed to low level radiation, 6:22681 (FDA—81-8042)

# M

**MA 754**
*See NICKEL BASE ALLOYS*
**MACHINE PARTS**
**Surface Finishing**
Effect of workpiece edge angle on radius produced by vibratory finishing, 6:22417 (BDX—613-2620)
**MAGMA**
**Chemical Composition**
Partial molar volumes of oxide components in silicate liquids, 6:22734
**MAGMA SYSTEMS**
**Bibliographies**
Geothermal technology publications and related reports: a bibliography, January 1977-December 1980, 6:21954 (SAND—81-0662)
**Geochemistry**
Regular solution model for met-aluminous silicate liquids: applications to geothermometry, immiscibility, and the source regions of basic magmas, 6:22735
**Phase Studies**
Regular solution model for met-aluminous silicate liquids: applications to geothermometry, immiscibility, and the source regions of basic magmas, 6:22735
**MAGNESIUM**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Cosmic Nuclei**
Anomalous isotoptic composition of cosmic rays, 6:22741
**Production**
Assessment of the magnesium primary production technology. Final report, 6:22267 (DOE/CS/40284—T1)
**Removal**
Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)
**Uses**
Assessment of the magnesium primary production technology. Final report, 6:22267 (DOE/CS/40284—T1)
**MAGNESIUM COMPLEXES**
**Electronic Structure**
Electronic structural properties and photosynthesis, 6:21810
**Structural Chemical Analysis**
Electronic structural properties and photosynthesis, 6:21810
**MAGNESIUM IONS**
**Oscillator Strengths**
Atomic structure calculations using the relativistic random phase approximation, 6:22755 (ANL—80-126)
**MAGNET COILS**
**Design**
Bow-shaped toroidal field coils, 6:22918 (PPPL—1790)
**MAGNETIC COILS**
*See MAGNET COILS*
**MAGNETIC ENERGY STORAGE**
*See also MAGNETIC ENERGY STORAGE EQUIPMENT*
**Energy Transfer**
Three phase energy transfer circuit with superconducting energy storage coils, 6:22961
**Superconducting Magnets**
Force and inductance calculations for pulsed energy storage shielded magnets, 6:22085
**MAGNETIC ENERGY STORAGE EQUIPMENT**
**Design**
Superconducting magnetic energy storage applications and benefits for electric utility power systems, 6:22086
**MAGNETIC MONOPOLES**
**Gauge Invariance**
Systematic framework for generating multimonopole solutions, 6:22839
**Yang-Mills Theory**
Construction of exact Yang-Mills-Higgs multimonopoles of arbitrary charge, 6:22842
**MAGNETIC REFRIGERATORS**
**Design**
Magnetic refrigeration for spacecraft systems, 6:22421 (LA-UR—81-1084)
**Performance**
Magnetic refrigeration for spacecraft systems, 6:22421 (LA-UR—81-1084)
**MAGNETIC SPECTROMETERS**
**Toroidal Configuration**
Toroidal magnetic detector, 6:22483 (DOE/ER/03072—1)
**MAGNETIC SURVEYS**
**Calibration Standards**
Dynamic Test Range I: follow-on. Narrative report, 6:21625 (GJBX—110-81)
**MAGNETITE**
**Catalytic Effects**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)
**MAGNETOHYDRODYNAMIC CHANNELS**
*See MHD CHANNELS*
**MAGNETOHYDRODYNAMIC GENERATORS**
*See MHD GENERATORS*
**MAGNETOHYDRODYNAMICS**
**Boundary Layers**
Experimental and theoretical studies of the effects of nonuniformities in equilibrium magnetohydrodynamic flows, 6:22814
**MAINE**
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Heating Oils**
Heating oil supply/price monitoring report: Part I. Historic data, August 1978-July 1979. Part II. Current data, August 1979-May 1980, 6:21584 (DOE/EIA/06278—T2)
**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Peat**
Maine peat resource evaluation program, 6:21551
**MAINTENANCE**
*See also REACTOR MAINTENANCE*
**Environmental Effects**
Highway right-of-way: mowing versus succession as related to duck nesting, 6:22721
**MAIZE**
**Acid Hydrolysis**
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980 (Autohydrolysis), 6:21729 (SERI/TR—98174-1)
**Anaerobic Digestion**
Feasibility study for anaerobic digestion of agricultural crop residues. 1980 update. Final report, 6:21730 (SERI/TR—98175-1)
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980 (Autohydrolysis), 6:21729 (SERI/TR—98174-1)
**Solar Drying**
Corn drying with solar-dried desiccant, 6:21879
**MALIGNANCIES**
*See NEOPLASMS*

**MALONIC ACID**
**Electron Spectra**
Photoelectron spectroscopy of carbonyls: saturated normal dicarboxylic acids, 6:22382
**MAMMALS**
**Abundance**
Marine mammals of the Southeastern United States coast and the Gulf of Mexico, 6:22572 (FWS/OBS—80/41)
**Ecology**
Marine mammals of the Southeastern United States coast and the Gulf of Mexico, 6:22572 (FWS/OBS—80/41)
**Endangered Species**
Marine mammals of the Southeastern United States coast and the Gulf of Mexico, 6:22572 (FWS/OBS—80/41)
**Spatial Distribution**
Marine mammals of the Southeastern United States coast and the Gulf of Mexico, 6:22572 (FWS/OBS—80/41)
**MAMMARY GLANDS**
**Pathological Changes**
Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age, 6:22677 (FDA—81-8042)
**MAN**
*See also ADULTS*
*MEN*
*WOMEN*
**Vision**
Temporal modulation sensitivity of macaque monkeys, 6:22665
**MANGANESE**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**MANGANESE COMPOUNDS**
**Exchange Interactions**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1-c/Cl_3$, 6:22319
**Magnetic Susceptibility**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1-c/Cl_3$, 6:22319
**Mutagenesis**
Quantitative mammalian cell mutagenesis and a preliminary study of the mutagenic potential of metallic compounds, 6:22715
**Neutron Diffraction**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1-c/Cl_3$, 6:22319
**Spin Waves**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn/sub\ c/Cu/sub\ 1-c/Cl_3$, 6:22319
**MANGANESE SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581
**MANOMETERS**
*See PRESSURE GAGES*
**MANUFACTURING FACILITIES**
*See INDUSTRIAL PLANTS*
**MARICULTURE**
*See AQUACULTURE*
**MARINE DISPOSAL**
**Environmental Impacts**
Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)
**MARINE ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**MARYLAND**
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**MASS SPECTROSCOPY**
Nuclear materials analysis using plasma desorption mass spectometry, 6:21703
**MASSACHUSETTS**
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**MATERIAL BALANCE**
**Calculation Methods**
Material balance approach to estimating aquatic exposure concentrations, 6:22587
**MATERIAL BALANCE AREA**
**Inventories**
International safeguards at the feed and withdrawal area of a gas centrifuge uranium enrichment plant, 6:21699
**MATERIALS**
*See also BUILDING MATERIALS*
*POROUS MATERIALS*
*SYNTHETIC MATERIALS*
**Meetings**
Alternate nuclear waste forms and interactions in geologic media, 6:21653 (CONF-8005107—)
**Wave Propagation**
Novel analytic solutions to general four-wave-mixing problems in a Raman medium, 6:22874
**MATERIALS RECOVERY**
**Meetings**
Resource recovery '80 presentation summaries, 6:22244
**MATHEMATICAL MODELS**
*See also ATOMIC MODELS*
*HARMONIC OSCILLATOR MODELS*
*MOLECULAR MODELS*
In-situ combustion models for the steam plateau and for fieldwide oil recovery, 6:21570 (DOE/ET/12056—11)
**Comparative Evaluations**
Section 316(b) and modeling of ichthyoplankton entrainment, 6:22007 (CONF-810545—2)
**Linear Programming**
Identification of multivariate linear systems, 6:22971 (CONF-810406—5)
**Numerical Solution**
High-order accurate numerical algorithm for three-dimensional transport prediction, 6:22987
**MEASURE THEORY**
**Errors**
Methodologies for calculating measurement uncertainties, 6:22972 (CONF-810406—7)
**MEASUREMENTS WHILE DRILLING**
*See MWD SYSTEMS*
**MEASURING METHODS**
**Comparative Evaluations**
Biodegradation tests: use and value, 6:22362
**Errors**
Angular measurements in optical testing, 6:22431 (UCRL—84968)
**Optical Systems**
Angular measurements in optical testing, 6:22431 (UCRL—84968)
**MECHANICAL PROPERTIES**
*See also TENSILE PROPERTIES*
**Thermal Shock**
Mechanical properties of chemical vapor deposited coatings for fusion reactor application, 6:22923

**MEMBRANE TRANSPORT**
**Biochemical Reaction Kinetics**
Intestinal transport: studies with isolated epithelial cells, 6:22625
**Mathematical Models**
Separation of alkali, alkaline earth and rare earth cations by liquid membranes containing macrocyclic carriers. Third progress report, September 1, 1980-April 1, 1981, 6:22326 (DOE/ER/05016—3)
**MEMBRANES**
*See also CELL MEMBRANES*
*PHOTOSYNTHETIC MEMBRANES*
**Electron Transfer**
Novel approach to the growth of anaerobic microorganisms, 6:22648 (CONF-810554—1)
**Ion Exchange**
Anionic detergents as divalent cation ionophores across black lipid membranes, 6:22627
**Screening**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**MEN**
**Immunoglobulins**
Gm allotypes in mother-father-cord trios: a selective transfer of autologous, fetal IgG to the mother, 6:22667
**MENDELEVIUM**
**Chemistry**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:22413
**MERCURY**
**Binding Energy**
State-of-the-art for multiconfiguration Dirac-Fock calculations, 6:22753 (ANL—80-126)
**MERCURY COMPOUNDS**
**Chemical Reactions**
Organochromium(III) complexes derived from nitriles, 6:22388
**METABOLIC DISEASES**
**Diagnosis**
Two-dimensional electrophoretic mapping of human erythrocyte proteins, 6:22622
**METABOLIC PATHWAYS**
*See BIOLOGICAL PATHWAYS*
**METABOLITES**
**Chemiluminescence**
Specificity of chemiluminescence in the metabolism of benzo[a]pyrene to its carcinogenic diol epoxide, 6:22615
**Mutagenesis**
In vivo conversion of sodium azide to a stable mutagenic metabolite in Salmonella typhimurium, 6:22642
**METAL INDUSTRY**
**Process Heat**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)
**METALS**
*See also ACTINIDES*
*ALKALI METALS*
*ALKALINE EARTH METALS*
*LIQUID METALS*
*RARE EARTHS*
*REFRACTORY METALS*
**Electronic Structure**
Pressure-induced change in the Fermi surface and electronic structure of metals, 6:22279 (SAND—81-0558C)
**Fermi Level**
Pressure-induced change in the Fermi surface and electronic structure of metals, 6:22279 (SAND—81-0558C)
**Imports**
Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979 (Imports these elements in 1974, demand in 1985 and 2000), 6:21538 (DOE/MC/08004—T8)
**Microradiography**
Microradiographic characterization of metal and polymer coated microspheres, 6:22946
**Optical Properties**
Optical properties of metals, 6:22283
**Supply and Demand**
Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979 (Imports these elements in 1974, demand in 1985 and 2000), 6:21538 (DOE/MC/08004—T8)
**METEOROLOGY**
**Data Acquisition Systems**
On-site data acquisition system for photovoltaic applications experiments, 6:21823 (SAND—81-0897)
**METHACRYLIC ACID ESTERS**
**Copolymerization**
Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310
**METHANE**
**Biosynthesis**
Feasibility study for anaerobic digestion of agricultural crop residues. 1980 update. Final report, 6:21730 (SERI/TR—98175-1)
**Combustion**
Experimental and theoretical study of flame inhibition by bromine-containing compounds, 6:21731 (UCRL—85409)
**Diffusion**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**Ignition**
Strong ignition limits for methane-hydrogen mixtures, 6:21727 (LBL—12146)
**Phase Studies**
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576
**Recovery**
Methane-production-rate studies and gas-flow modeling for the Fresh Kills landfill, 6:21728 (NYSERDA—80-21)
**Separation Processes**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**METHANOL**
Status of the Mobil process for converting methanol to high quality gasoline, 6:21527
**Chromatography**
Continuous chromatographic reactor, 6:22361
**Production**
Synopsis of interim final report. conceptual design of a coal-to-methanol commercial plant, 6:21733
**METHYL METHANESULFONATE**
**Toxicity**
Cytotoxicity and mutagenicity of alkylating agents in cultured mammalian cells (CHO/HGPRT system): mutagen treatment in the presence or absence of serum, 6:22714
**METHYL PHENOLS**
*See CRESOLS*
**METHYL RADICALS**
**Excited States**
Energy storage in organic photoisomers, 6:21809
**Isomerization**
Energy storage in organic photoisomers, 6:21809
**Photochemistry**
Energy storage in organic photoisomers, 6:21809
**5-METHYL URACIL**
*See THYMINE*
**METHYLENE BLUE**
**Absorption Spectra**
Monolayer films of surfactant derivatives of methylene blue, 6:21808
**Scintillation Quenching**
Electron transfer in the quenching of protonated triplet methylene blue by ground-state molecules of the dye, 6:22398
**Solar Energy Conversion**
Monolayer films of surfactant derivatives of methylene blue, 6:21808
**METHYLENE RADICALS**
**Electronic Structure**
Methylene singlet-triplet separation: an explicit variational treatment of many-body correlation effects, 6:22383
**METHYLIDENE RADICALS**
*See METHYLENE RADICALS*

**MFTF DEVICES**
**Cryogenics**
Cryogenic system for the mirror fusion test facility, 6:22954
**Cryopumps**
Large scale cryopumps for fusion power systems, 6:22953
**Reviews**
Tandem-mirror program: status and projection, 6:22919 (UCID—18983)
**Superconducting Magnets**
Cryogenic system for the mirror fusion test facility, 6:22954
**MHD CHANNELS**
**Boundary Layers**
High magnetic field MHD generator program. Final report, July 1, 1976-December 31, 1979, 6:22144 (DOE/ET/10780—T1)
**Breakdown**
High magnetic field MHD generator program. Final report, July 1, 1976-December 31, 1979, 6:22144 (DOE/ET/10780—T1)
**Electric Arcs**
Detailed description of technical progress task 1, arcing phenomena in MHD generators, 6:22146 (DOE/ET/15518—3)
**Slags**
Detailed description of technical progress task 1, arcing phenomena in MHD generators, 6:22146 (DOE/ET/15518—3)
**MHD GENERATORS**
*See also COAL-FIRED MHD GENERATORS*
*DISK MHD GENERATORS*
Some aspects of the study of gas-discharge plasma and production of high magnetic fields (Book), 6:22152 (DOE-tr—73)
**Boundary Layers**
High magnetic field MHD generator program. Final report, July 1, 1976-December 31, 1979, 6:22144 (DOE/ET/10780—T1)
**Electrical Insulators**
Electrode module development and testing. Task 3, 6:22148 (DOE/ET/15518—3)
**Electrodes**
Electrode module development and testing. Task 3, 6:22148 (DOE/ET/15518—3)
Microwave gaseous electrode development. Final report, 6:22150 (DOE/ET/15619—T1)
**Heat Recovery**
MHD heat and seed recovery technology project. Ninth quarterly report, January-March 1980, 6:22142 (ANL/MHD—80-8)
**Plasma Diagnostics**
High magnetic field MHD generator program. Final report, July 1, 1976-December 31, 1979, 6:22144 (DOE/ET/10780—T1)
**Research Programs**
Key contributions in MHD power generation. Quarterly technical progress report, September 1, 1979-November 30, 1979, 6:22145 (DOE/ET/15518—3)
**Seed Recovery**
MHD heat and seed recovery technology project. Ninth quarterly report, January-March 1980, 6:22142 (ANL/MHD—80-8)
**Superconducting Magnets**
High magnetic field MHD generator program. Final report, July 1, 1976-December 31, 1979, 6:22144 (DOE/ET/10780—T1)
**MHD POWER PLANTS**
**Air Heaters**
MHD air heater technology development. Annual technical progress report, January 1, 1980-December 31, 1980, 6:22149 (DOE/ET/15602—T4)
**Boilers**
Analysis of flow, gas-particle radiation, and particulate deposition in radiant boilers, 6:22143 (ANL/MHD—81-5)
**Performance**
Performance calculations for 200-1000 MWe MHD/steam power plants, 6:22151 (DOE/NASA/10769—16)
**MICELLAR SYSTEMS**
**Chemical Radiation Effects**
Electron capture in water pools of reversed micelles, 6:22406
**Electron Attachment**
Electron capture in water pools of reversed micelles, 6:22406
**MICHIGAN**
**Peat**
Michigan's organic soils - an immense untapped energy resource, 6:21548
**MICROBIAL EOR**
**Research Programs**
Use of microorganisms in enhanced oil recovery, 6:21569 (DOE/BC/10300—10)
**MICROBIAL FLORA**
*See MICROORGANISMS*
**MICROFLORA**
*See MICROORGANISMS*
**MICROORGANISMS**
*See also BACTERIA*
*VIRUSES*
**Biological Radiation Effects**
Irradiation of microorganism such as bacteria and viruses in the presence of chemical enhancing agent, 6:22696
**Population Dynamics**
Microbial roles in aquatic food webs, 6:22654
**MICROSEISMIC MONITORING**
*See ACOUSTIC MONITORING*
**MICROSPHERES**
**Coatings**
Plastic coating of microsphere substrates, 6:22941
**Lung Clearance**
Retention of microspheres in the rat lung after intratracheal instillation, 6:22706
**MICROWAVE EQUIPMENT**
**Performance Testing**
Feasibility study of a microwave application for solar-cell fabrication. Annual report for period ending February, 1981, 6:21781 (SERI/PR—8041-16-T1)
**MICROWAVE POWER TRANSMISSION**
**Environmental Impacts**
SPS ionosphere/microwave beam interactions: Arecibo experimental studies, 6:21752 (LA-UR—80-3095)
**Interference**
SPS susceptible-system cost factors investment summary and mitigation-cost-increment estimates, 6:21751 (DOE/ER/10160—T3)
**MICROWAVE RADIATION**
**Biological Effects**
Advances in microwave-induced neuroendocrine effects: the concept of stress (Rats), 6:22720
**Health Hazards**
Advances in microwave-induced neuroendocrine effects: the concept of stress (Rats), 6:22720
**MID-ATLANTIC REGION**
*See also NEW JERSEY*
*NEW YORK*
*PUERTO RICO*
**Uranium Deposits**
Some concepts of favorability for world-class-type uranium deposits in the northeastern United States, 6:21622 (GJBX—80(81))
**MIGRATION (RADIONUCLIDE)**
*See RADIONUCLIDE MIGRATION*
**MINE HAULAGE**
**Research Programs**
The US Department of Energy's coal mining research, 6:21554
**MINE-MOUTH GENERATING PLANTS**
*See COAL MINES*
*FOSSIL-FUEL POWER PLANTS*
**MINERAL RIGHTS**
**Ownership**
Final environmental impact statement. Green River-Hams Fork regional coal, 6:22598
Final environmental impact statement. Alabama Electric Cooperative, purchase of coal property leases, 6:22606
**MINERAL WASTES**
**Catalytic Effects**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report,

December 1, 1979-February 29, 1980, 6:21500 (DOE/ET/14806—T3)

**Chemical Composition**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)

**Thermal Gravimetric Analysis**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, December 1, 1979-February 29, 1980, 6:21500 (DOE/ET/14806—T3)
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)

**MINERALS**
*See also ANHYDRITE*
*CLAYS*
*DIAMONDS*
*MAGNETITE*
*PYRRHOTITE*

**Catalytic Effects**
Low-rank coal study: national needs for resource development. Volume 3. Technology evaluation, 6:21487 (DOE/FC/10066—T1-(Vol.3))
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, December 1, 1979-February 29, 1980, 6:21500 (DOE/ET/14806—T3)

**Chemical Composition**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)

**Processing**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)

**Thermal Gravimetric Analysis**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, December 1, 1979-February 29, 1980, 6:21500 (DOE/ET/14806—T3)
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)

**MINING EQUIPMENT**

**Power Demand**
Coal gettability testing: the evaluation methods and coal gettability checking in strata, 6:21555 (DOE/TIC—1015202)
Coal gettability studies: methods of evaluation and verification of coal deposited in seams, 6:21552 (DOE/TIC—1016824)

**Ropes**
Wire rope research and logging (Skyline and dragline systems), 6:22425 (PNL-SA—8797)

**MINING RIGHTS**
*See MINERAL RIGHTS*

**MINNESOTA**

**Land Reclamation**
Peatland reclamation - the energy crop option, 6:21553

**Peat**
Peat resource estimation project in Minnesota, 6:21549

**MIRROR FUSION TEST FACILITY**
*See MFTF DEVICES*

**MITOGENS**
*See also PHYTOHEMAGGLUTININ*

**Biological Effects**
Alterations of two-dimensional electrophoretic maps in human peripheral blood lymphocytes induced by concanavalin A, 6:22711

**MOBIL M-GASOLINE PROCESS**
*See also SYNTHETIC FUELS*

**Comparative Evaluations**
Status of the Mobil process for converting methanol to high quality gasoline, 6:21527

**Pilot Plants**
Status of the Mobil process for converting methanol to high quality gasoline, 6:21527

**MOBILE HOMES**

**Design**
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes, 6:22194 (DOE/TIC—11453)

**Energy Consumption**
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes, 6:22195 (DOE/TIC—11454)

**Energy Efficiency Standards**
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes, 6:22194 (DOE/TIC—11453)
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes, 6:22195 (DOE/TIC—11454)
Phase-two report for the development of Energy-Performance Standards for new buildings. Final report, 6:22198 (DOE/TIC—11457)

**Specifications**
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: mobile homes, 6:22194 (DOE/TIC—11453)

**MOBILE POLLUTANT SOURCES**

**Distribution**
Mobile source emission inventory, 6:22544 (EPA-AA-TEB—81-11)

**MOBILITY**

**Control**
Linear oil displacement by the emulsion entrapment process, 6:21577

**MODELS (ATOMIC)**
*See ATOMIC MODELS*

**MODELS (BIOLOGICAL)**
*See BIOLOGICAL MODELS*

**MODELS (MATHEMATICAL)**
*See MATHEMATICAL MODELS*

**MODELS (OPTICAL)**
*See OPTICAL MODELS*

**MODIFIED IN-SITU PROCESSES**

**Decommissioning**
Retort abandonment: issues and research needs, 6:21617 (LBL—11197)

**MOLDS**
*See FUNGI*

**MOLECULAR BEAMS**

**Beam Monitoring**
Spatial mapping of concentrations in pulsed and continuous atom sources, 6:22401

**MOLECULAR BIOLOGY**

**Information Systems**
Estimation of two-dimensional electrophoretic spot intensities and positions by modeling, 6:22619

**MOLECULAR MODELS**

**Schroedinger Equation**
Calculations of relativistic effects in atoms and molecules from the Schroedinger wave function, 6:22752 (ANL—80-126)

**MOLECULAR ORBITAL MODEL**
*See ATOMIC MODELS*
*MOLECULES*

**MOLECULAR STRUCTURE**

**Calculation Methods**
Super-CI MCHF program in ALCHEMY, 6:22782 (LBL—12157)

**MOLECULE COLLISIONS**
*See also ATOM-MOLECULE COLLISIONS*
*ELECTRON-MOLECULE COLLISIONS*
*PHOTON-MOLECULE COLLISIONS*
Theoretical investigation and calculation of certain atomic and molecular processes important in the formation and destruction of excited stable gas molecules (or excimers). Final report, October 1, 1978-November 30, 1979, 6:22771 (DOE/DP/40017—T1)

**MOLECULES**
*See also POLYATOMIC MOLECULES*

**Computerized Simulation**
Computer simulations of a continuum system of molecules with a hard-core interaction in the grand canonical ensemble, 6:22867
**Excited States**
Molecular resonance phenomena (Calculation of resonance widths), 6:22792 (UCRL—85858)
**Interatomic Forces**
Molecular potentials and relaxation dynamics, 6:22791 (UCRL—85577(Rev.1))
**Metastable States**
Theoretical investigation and calculation of certain atomic and molecular processes important in the formation and destruction of excited stable gas molecules (or excimers). Final report, October 1, 1978-November 30, 1979, 6:22771 (DOE/DP/40017—T1)
**Wave Functions**
General quadratically convergent MCSCF theory in terms of reduced matrix elements, 6:22783 (LBL—12157)

**MOLTEN CARBONATE FUEL CELLS**
**Design**
Development of molten-carbonate fuel-cell technology. Technical status report, August-October 1980, 6:22157 (DOE/ET/11304—T7)
**Fabrication**
High-temperature molten-carbonate fuel cells. Technical progress report, January-March 1979, 6:22158 (DOE/ET/11304—T10)
**Heat Exchangers**
Evaluation of alloys for fuel cell heat exchangers. Final report (Texaco entrained gasifier), 6:21511 (EPRI-EM—1815)
**Performance Testing**
Development of molten-carbonate fuel-cell technology. Technical status report, August-October 1980, 6:22157 (DOE/ET/11304—T7)
High-temperature molten-carbonate fuel cells. Technical progress report, January-March 1979, 6:22158 (DOE/ET/11304—T10)

**MOLYBDENUM**
Evaluation of molybdenum and its alloys (Reactor core heat pipes), 6:22273 (LA-UR—81-1400)
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Degassing**
Gas release studies from explosion-cladded materials, 6:22922
**Ion Collisions**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**Leaching**
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
**Sputtering**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285

**MOLYBDENUM ALLOYS**
Evaluation of molybdenum and its alloys (Reactor core heat pipes), 6:22273 (LA-UR—81-1400)
**Thermodynamic Properties**
Combined thermodynamic study of nickel-base alloys. Progress report, 6:22271 (DOE/OR/05951—T1)

**MOLYBDENUM BORIDES**
**Physical Radiation Effects**
Comments on '30 K fast neutron and fission fragment irradiations of two Fe-B type amorphous alloys', 6:22304

**MOLYBDENUM COMPOUNDS**
**Auger Effect**
Analysis of transition metal carbonyl Auger line shapes, 6:22322

**MOLYBDENUM IONS**
**Energy-Level Transitions**
3d—4p transitions in the zinclike and copperlike ions Y X, XI; Zr XI, XII; Nb XII, XIII; and Mo XIII, XIV, 6:22281

**MOLYBDENUM SULFIDES**
**Antiferromagnetism**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581
**Ferromagnetism**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Magnetization**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Neutron Diffraction**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Superconductivity**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Transition Temperature**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317

**MONAZITES**
Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D, 6:21687 (UCRL—15347)
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)

**MONKEYS**
**Vision**
Temporal modulation sensitivity of macaque monkeys, 6:22665

**MONTANA**
**Geothermal Exploration**
Audio-magnetotelluric data log and station-location map for the Silver Star Hot Springs area, Montana, 6:21963 (USGS-OFR—79-1307)
**Households**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
**Magnetic Surveys**
Aerial radiometric and magnetic study: Wallace National Topographic map, Idaho/Montana. Final report, 6:21626 (GJBX—111(81))
**Magnetotelluric Surveys**
Audio-magnetotelluric data log and station-location map for the Silver Star Hot Springs area, Montana, 6:21963 (USGS-OFR—79-1307)
**Radiometric Surveys**
Aerial radiometric and magnetic study: Wallace National Topographic map, Idaho/Montana. Final report, 6:21626 (GJBX—111(81))

**MORTALITY**
**Dose-Response Relationships**
Adjusting survival data for covariates, 6:22541 (CONF-801045—)
**Statistical Models**
Statistical review of cross-sectional studies of ambient air pollution and mortality, 6:22703 (CONF-801045—)

**MOTORS**
*See also ELECTRIC MOTORS*
**Energy Efficiency**
Local government guide to the emerging technologies of energy-efficient motors and heat pumps. Energy technology report of the energy task force of the urban consortium, 6:22250 (DOE/IR/05106—T8)

**Operation**
Local government guide to the emerging technologies of energy-efficient motors and heat pumps. Energy technology report of the energy task force of the urban consortium, 6:22250 (DOE/IR/05106—T8)
**MULTICHARGED IONS**
**Lamb Shift**
Summary on experiments, 6:22768 (ANL—80-126)
**MULTIWIRE PROPORTIONAL CHAMBERS**
*See also DRIFT CHAMBERS*
**Performance**
Effective trigger at the Brookhaven Multi-Particle Spectrometer (MPS), 6:22513
**Response Functions**
Real-time tritium monitor with an MPC proportional response to airborne mixtures of TH and THO, 6:22515
**Trigger Circuits**
Effective trigger at the Brookhaven Multi-Particle Spectrometer (MPS), 6:22513
**MUNICIPAL BUILDINGS**
*See PUBLIC BUILDINGS*
**MUNICIPAL WASTES**
*See also REFUSE DERIVED FUELS*
**Anaerobic Digestion**
Evaluation of mixing systems for biogasification of municipal solid waste, 6:22256 (DOE/CS/20100—T2)
**Energy Recovery**
Status report on energy recovery from municipal solid waste: technologies, lessons and issues. Information bulletin of the energy task force of the urban consortium, 6:22249 (DOE/IR/05106—T6)
**Mixing**
Evaluation of mixing systems for biogasification of municipal solid waste, 6:22256 (DOE/CS/20100—T2)
**Waste Management**
Regional resource recovery feasibility study for Western Piedmont and Centralina Council of Governments, 6:22254 (NCEI—0024)
**MUONIUM**
**Chemical Reactions**
Muonium chemistry: a review, 6:22380
**MUONS**
**Monitoring**
Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)
**MUTAGENESIS**
**Research Programs**
Of mice and mutagens, 6:22697
**MUTAGENIC PATHWAYS**
*See BIOLOGICAL PATHWAYS*
**MUTAGENS**
*See also EMS*
*METHYL METHANESULFONATE*
**Genetic Effects**
In vivo conversion of sodium azide to a stable mutagenic metabolite in Salmonella typhimurium, 6:22642
**Metabolism**
In vivo conversion of sodium azide to a stable mutagenic metabolite in Salmonella typhimurium, 6:22642
**MUTATION INDUCTION PATHWAYS**
*See BIOLOGICAL PATHWAYS*
**MWD SYSTEMS**
*(Measurements While Drilling Systems.)*
**Performance**
Pulsating-flow measurement with an orifice flange, 6:21971 (EGG—1183-1797)
**MX DEVICES**
*See MFTF DEVICES*
**MYOCARDIUM**
**Hypertrophy**
Association of myocardial cell necrosis with experimental cardiac hypertrophy, 6:22658
**Necrosis**
Association of myocardial cell necrosis with experimental cardiac hypertrophy, 6:22658
**MYXEDEMA**
*See HYPOTHYROIDISM*

## N

**NAPHTHA**
**Supply and Demand**
EDS coal-liquefaction process development. Phase V. EDS product quality. Interim report, 6:21492 (DOE/ET/10069—T5)
**NASA**
*(National Aeronautics and Space Administration.)*
**Wind Power Plants**
Large wind turbines: early operational experience and potential for supplying electricity, 6:21979
**NATIONAL ACCELERATOR LABORATORY**
*See FERMILAB ACCELERATOR*
**NATIONAL ENERGY PLAN**
**Economic Impact**
Petroleum refining industry in the 1980s: impact of the National Energy Plan and related legislation, 6:21591 (ORAU/IEA—81-3(M))
**NATURAL CIRCULATION**
*See NATURAL CONVECTION*
**NATURAL CONVECTION**
**Computer Calculations**
Natural convection analyses and verification for LMFBR cores, 6:22030
**NATURAL GAS**
*See also LIQUEFIED NATURAL GAS*
**Consumption Rates**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))
**Production**
Devonian shale, 6:21606
**Purification**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**NATURAL GAS DEPOSITS**
**Exploration**
Quantitative analysis of the economically recoverable resource, 6:21597 (DOE/MC/08216—157)
**Leases**
United States Depratment of the Interior final environmental impact statement, 6:21590
**Resource Assessment**
Quantitative analysis of the economically recoverable resource, 6:21597 (DOE/MC/08216—157)
**Well Stimulation**
Transient stress analysis of high-energy gas-fracture experiments, 6:21604 (SAND—81-0703)

**NATURAL GAS WELLS**
**Well Spacing**
Quantitative analysis of the economically recoverable resource, 6:21597 (DOE/MC/08216—157)
**Well Stimulation**
Quantitative analysis of the economically recoverable resource, 6:21597 (DOE/MC/08216—157)
Western Gas Sands Project. Status report, October-November-December 1980, 6:21602 (DOE/BC/10003—18)
**NATURAL LIGHTING**
*See DAYLIGHTING*
**NATURAL RADIOACTIVITY**
*(For unspecified naturally occuring radioisotopes only; not for BACKGROUND RADIATION.)*
**Calibration Standards**
Development of some natural matrix standards - progress report, 6:22331
**NAVIER-STOKES EQUATIONS**
**Finite Element Method**
Solution of the time-dependent incompressible Navier-Stokes equations via a penalty Galerkin finite element method, 6:22445 (UCRL—85354)
**NEBRASKA**
**Geochemical Surveys**
Hydrogeochemical and stream sediment reconnaissance basic data for Scottsbluff NTMS Quadrangle, Nebraska and Colorado, 6:21641 (GJBX—145(81))
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**NEGATIVE IONS**
*See ANIONS*
**NEODYMIUM IONS**
**Electron Spin Resonance**
Measurement of pair interactions in neodymium ethyl sulfate, 6:22774 (DOE/EV/72005—T2)
**NEODYMIUM LASERS**
**Mode Locking**
Actively mode-locked and Q-switched oscillator system (21 Aug 1980) (Engineering Materials) (Argus), 6:22966 (CAPE—2694)
**Q-Switching**
Actively mode-locked and Q-switched oscillator system (21 Aug 1980) (Engineering Materials) (Argus), 6:22966 (CAPE—2694)
**NEODYMIUM PHOSPHATES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**NEODYMIUM SULFATES**
**Crystal Field**
Measurement of pair interactions in neodymium ethyl sulfate, 6:22774 (DOE/EV/72005—T2)
**NEOMYCIN**
*See ANTIBIOTICS*
**NEON**
**Cosmic Nuclei**
Anomalous isotoptic composition of cosmic rays, 6:22741
**NEON 20 REACTIONS**
**Breakup Reactions**
Nuclear equation of state studied with high-energy heavy ions, 6:22854 (LA-UR—81-1555)
**NEON 20 TARGET**
**Electron Reactions**
Orbital recoupling dominance in the A = 20 isovector giant M1 transition, 6:22849
**Pion Minus Reactions**
Orbital recoupling dominance in the A = 20 isovector giant M1 transition, 6:22849
**NEON IONS**
**Dissociation Energy**
Geometry and spectral properties of $Ne^{+}_{3}$, $Ar^{+}_{3}$, $Kr^{+}_{3}$, and $Xe^{+}_{3}$, 6:22793
**NEONATES**
**Biological Radiation Effects**
Effect of prenatal irradiation on total litter birth weight, 6:22685 (FDA—81-8042)
**Immunoglobulins**
IgG levels in mother-father-cord trios: evidence for a large reduction of maternal IgG at birth, 6:22668
**Weight**
Effect of prenatal irradiation on total litter birth weight, 6:22685 (FDA—81-8042)
**NEOPLASMS**
*See also LYMPHOMAS*
**Neutron Sources**
$10^{13}$/s 14 MeV neutron generator for cancer therapy, 6:21721
**Radioinduction**
Principal disease or cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22676 (FDA—81-8042)
**Therapy**
$10^{13}$/s 14 MeV neutron generator for cancer therapy, 6:21721
**NETWORKS (COMPUTER)**
*See COMPUTER NETWORKS*
**NEUTRINO DETECTION**
**Measuring Methods**
Solar neutrino experiments and neutrino oscillations, 6:22736 (BNL—29440)
**NEUTRINOS**
*See also COSMIC NEUTRINOS*
*SOLAR NEUTRINOS*
**Magnetic Dipole Moments**
Magnetic moment of massive neutrinos and the cosmic helium abundances, 6:22826
**NEUTRON REACTIONS**
**Cross Sections**
New aspects in the evaluation of thermal neutron cross sections, 6:22858 (BNL-NCS—29035)
**NEUTRON SOURCES**
*(Excludes reactors even when used as neutron sources.)*
**Deuteron Reactions**
$10^{13}$/s 14 MeV neutron generator for cancer therapy, 6:21721
**Triton Reactions**
$10^{13}$/s 14 MeV neutron generator for cancer therapy, 6:21721
**NEUTRON SPECTROSCOPY**
**Coincidence Methods**
Method for determining the neutron multiplicity for gamma rays from (particle,xn$\gamma$) reactions (n-$\gamma$ coincidence), 6:22845
**NEUTRONS**
*See also THERMAL NEUTRONS*
**Monitoring**
Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)
**NEVADA**
**Geophysical Surveys**
Geophysical investigations in deep horizontal holes drilled ahead of tunnelling, 6:22728
**Heat Flow**
Heat flow in relation to hydrothermal activity in the southern Black Rock Desert, Nevada, 6:21964 (USGS-OFR—79-1467)
**NEVADA TEST SITE**
**Geologic Deposits**
Correlation characteristics of surficial deposits with a description of surficial stratigraphy in the Nevada test site region, 6:22722 (DOE/ET/44802—T1)
**Radioactive Waste Storage**
Nevada nuclear waste storage investigations. Quarterly report, October-December, 1980, 6:21674 (NVO—196-21)
**Radioactivity**
Radiochemical data collected on events from which radioactivity escaped beyond the borders of the Nevada test range complex, 6:22529 (UCRL—52934)
**NEW ENGLAND**
*See NORTH ATLANTIC REGION*
**NEW HAMPSHIRE**
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)

**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)

**NEW JERSEY**
**Heating Oils**
Program to monitor the weekly retail price of home-heating fuel oil No. 2 in the State of New Jersey. Year one final report, 6:21585 (DOE/EIA/10169—T1)

**NEW MEXICO**
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)

**NEW YORK**
**Fossil-Fuel Power Plants**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Nuclear Power Plants**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)

**NEW ZEALAND**
**Geothermal Resources**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)

**NEWTON MECHANICS**
*See CLASSICAL MECHANICS*

**NICKEL**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Adsorption**
Chemisorption—corrosion transition: The role of surface impurities as markers for evaluating the transition, 6:22290
**Chemisorption**
Chemisorption—corrosion transition: The role of surface impurities as markers for evaluating the transition, 6:22290
Two-dimensional chemisorbed phases, 6:22287
**Corrosion**
Chemisorption—corrosion transition: The role of surface impurities as markers for evaluating the transition, 6:22290
**Desorption**
Argon ion impact desorption cross sections of chlorine and carbon from nickel, 6:22951
**Evaporation**
Infrared spectra of carbon monoxide on evaporated nickel films: a low temperature thermal detection technique, 6:22379
**Ion Collisions**
Argon ion impact desorption cross sections of chlorine and carbon from nickel, 6:22951
**Oxidation**
Chemisorption—corrosion transition: The role of surface impurities as markers for evaluating the transition, 6:22290
**Sorptive Properties**
Infrared spectra of carbon monoxide on evaporated nickel films: a low temperature thermal detection technique, 6:22379

**NICKEL ALLOYS**
*See also NICKEL BASE ALLOYS*
**Electrodeposition**
Galvanic deposition of superinvar alloys, 6:22293 (UCRL-Trans—11676)

**NICKEL BASE ALLOYS**
*See also INCONEL ALLOYS*
*NIMONIC*
**Thermodynamic Properties**
Combined thermodynamic study of nickel-base alloys. Progress report, 6:22271 (DOE/OR/05951—T1)

**NICKEL COMPOUNDS**
**Auger Effect**
Analysis of transition metal carbonyl Auger line shapes, 6:22322
**Mutagenesis**
Quantitative mammalian cell mutagenesis and a preliminary study of the mutagenic potential of metallic compounds, 6:22715

**NICKEL SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581

**NIMONIC**
**Corrosion**
Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)

**NIOBIUM**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Degassing**
Gas release studies from explosion-cladded materials, 6:22922

**NIOBIUM 93 TARGET**
**Electron Reactions**
Exchange current effects in magnetic electron scattering from $^{49}$Ti, $^{51}$V, $^{59}$Co, $^{87}$Sr, and $^{93}$Nb, 6:22850

**NIOBIUM ALLOYS**
**Phase Transformations**
Quantitative x-ray microanalysis of U-Nb alloys with the scanning transmission electron microscope, 6:22278 (SAND—81-0147C)
**Thermodynamic Properties**
Combined thermodynamic study of nickel-base alloys. Progress report, 6:22271 (DOE/OR/05951—T1)
**X-Ray Radiography**
Quantitative x-ray microanalysis of U-Nb alloys with the scanning transmission electron microscope, 6:22278 (SAND—81-0147C)

**NIOBIUM COMPOUNDS**
**Specific Heat**
Fluctuation heat capacity of amorphous $Nb_3Ge$ films, 6:22291

**NIOBIUM IONS**
**Energy-Level Transitions**
3d—4p transitions in the zinclike and copperlike ions Y X, XI; Zr XI, XII; Nb XII, XIII; and Mo XIII, XIV, 6:22281

**NIOBIUM ISOTOPES**
**Gamow-Teller Rules**
Gamow-Teller strength distribution in the vicinity of A = 90. Pt. 1. Schematic calculation of GT strength in $^{90,92,94}$Nb, 6:22853

**NIOBIUM SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581

**NITRATES**
**Toxicity**
Studies of pollutant aerosol simulants in normal and susceptible human subjects, 6:22716

**NITRIC ACID**
**Chemical Reaction Yield**
Reaction kinetics of nitrogen dioxide with liquid water at low partial pressure, 6:22369
**Chemical Reactions**
Reaction of sugar with nitric acid, 6:22333 (ORNL—5738)

**NITRIC OXIDE**
**Chemical Reaction Kinetics**
Characterization of the selective reduction of NO by $NH_3$, 6:22465 (LBL—12215)

**Fluorescence**
VUV fluorescence following photodissociation of $N_2O$ at 193 nm, 6:22795
**Reduction**
Characterization of the selective reduction of NO by $NH_3$, 6:22465 (LBL—12215)
Influence of fuel sulfur on the selective reduction of NO by $NH_3$, 6:21596 (LBL—12128)

**NITRILES**
*See also ACRYLONITRILE*
**Chemical Preparation**
Organochromium(III) complexes derived from nitriles, 6:22388
**Chemical Reactions**
Organochromium(III) complexes derived from nitriles, 6:22388
**Nuclear Magnetic Resonance**
Study of liquid crystal conformation by multiple quantum NMR: n-pentyl cyanobiphenyl, 6:22391

**NITRILOTRIACETIC ACID**
*See NTA*

**NITRITES**
**Chemical Reactions**
Kinetics of the formation of hydroxylamine disulfonate by reaction of nitrite with sulfites, 6:22366

**NITRO COMPOUNDS**
*See also TNT*
**Chemical Radiation Effects**
Intramolecular electron transfer and dehalogenation of anion radicals. 2. Halonitroaromatic compounds, 6:22407

**NITROGEN**
Moessbauer characterization of reactively sputtered iron nitride films, 6:22303
Water vapor pressure gauge, 6:22451
**Chemical Reactions**
Critical conditions for the growth of SiC, $Si_3N_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981, 6:22295 (DOE/ER/10438—T1)
**Diffusion**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**Excited States**
Molecular resonance phenomena (Calculation of resonance widths), 6:22792 (UCRL—85858)
**Separation Processes**
Membrane separation of a $CO_2$-$N_2$ mixture using steam, 6:22360
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600

**NITROGEN COMPOUNDS**
**Bending**
High temperature applications of structural ceramics. Quarterly progress report, January-March 1981, 6:22296 (DOE/OR/20679—T4)
**Exchange Interactions**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn$/sub c/Cu/sub 1-c/$Cl_3$, 6:22319
**Magnetic Susceptibility**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn$/sub c/Cu/sub 1-c/$Cl_3$, 6:22319
**Neutron Diffraction**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn$/sub c/Cu/sub 1-c/$Cl_3$, 6:22319
**Spin Waves**
Low-temperature study of the static and dynamical magnetic properties of the random one-dimensional antiferromagnet $(CD_3)_4NMn$/sub c/Cu/sub 1-c/$Cl_3$, 6:22319

**NITROGEN DIOXIDE**
**Biological Effects**
Effect of lung damage by acute exposure to nitrogen dioxide on lung immunity in the rat, 6:22708
**Chemical Reactions**
Reaction kinetics of nitrogen dioxide with liquid water at low partial pressure, 6:22369
**Toxicity**
Effect of lung damage by acute exposure to nitrogen dioxide on lung immunity in the rat, 6:22708

**NITROGEN IONS**
**Collisions**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285

**NITROGEN OXIDES**
*See also NITRIC OXIDE*
*NITROGEN DIOXIDE*
*NITROUS OXIDE*
**Air Pollution Control**
State of fluidized bed combustion technology, 6:22462
**Emission**
Regional and national NO/sub x/ emissions, 6:22537 (ANL/EES-TM—130)
**Environmental Impacts**
Air quality analysis of Phase I of the proposed oil backout legislation (Lead abstract), 6:21540 (ANL/EES-TM—130)
Air quality analysis of Phase I of the proposed oil backout legislation: Introduction, 6:22229 (ANL/EES-TM—130)
**Monitoring**
Emissions inventory for the SURE Region. Final report, 6:22545 (EPRI-EA—1913)
Mobile source emission inventory, 6:22544 (EPA-AA-TEB—81-11)

**NITROSO COMPOUNDS**
**Toxicity**
Cytotoxicity and mutagenicity of alkylating agents in cultured mammalian cells (CHO/HGPRT system): mutagen treatment in the presence or absence of serum, 6:22714
Mutagenicity of N-nitrosopiperazine derivatives in Saccharomyces cerevisiae, 6:22710

**NITROUS OXIDE**
**Matrix Isolation**
Matrix interactions with rare-gas oxide excimers, 6:22747
**Photolysis**
VUV fluorescence following photodissociation of $N_2O$ at 193 nm, 6:22795

**NOBELIUM**
**Chemistry**
Chemistry of the heaviest actinides: fermium, mendelevium, nobelium, and lawrencium, 6:22413

**NOBLE GASES**
*See RARE GASES*

**NONAXIAL NUCLEI**
*See DEFORMED NUCLEI*

**NORBORNADIENE**
**Excited States**
Energy storage in organic photoisomers, 6:21809
**Isomerization**
Energy storage in organic photoisomers, 6:21809
**Photochemistry**
Energy storage in organic photoisomers, 6:21809

**NORTH AMERICA**
*See also CANADA*
*USA*
**Geothermal Resources**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)

**NORTH ATLANTIC REGION**
*See also CONNECTICUT*
*MAINE*
*MASSACHUSETTS*
*NEW HAMPSHIRE*
*RHODE ISLAND*
**Energy Source Development**
Strategy papers prepared by the Implementation Group of the New England Energy Congress, 6:22119 (DOE/TIC—1022409)
**Hydroelectric Power**
Computer model for small-scale hydropower policy analysis, 6:21735
**Uranium Deposits**
Some concepts of favorability for world-class-type uranium deposits in the northeastern United States, 6:21622 (GJBX—80(81))

**NORTH CAROLINA**
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**NORTHERN IRELAND**
*See UNITED KINGDOM*
**NOVA FACILITY**
**Optical Systems**
Reactively sputtered oxide optical coatings for inertial confinement fusion laser components, 6:22958
**NOZZLES**
**Cavitation**
Some factors affecting the metering of subcooled water with a choked venturi, 6:22071 (CONF-810406—4)
**Design**
Design and performance of atomizing nozzles for spray calcination of high-level wastes, 6:21680 (PNL—3702)
**Performance**
Design and performance of atomizing nozzles for spray calcination of high-level wastes, 6:21680 (PNL—3702)
**NTA**
**Biodegradation**
Role of biodegradation kinetics in predicting environmental fate, 6:22589
**Environmental Impacts**
Nitrilotriacetate: hindsight and gunsight, 6:22592
**NUCLEAR DATA COLLECTIONS**
Compilation of requests for nuclear data, 6:22843 (DOE/NDC—22/U)
**NUCLEAR ENERGY**
**Research Programs**
Current energy research and development in Washington State, 1980, 6:22107 (WAOENG—80-17)
**NUCLEAR EXPLOSIONS**
**Remote Sensing**
Energy and technology review, 6:22920 (UCRL—52000-81-6)
**NUCLEAR FACILITIES**
*See also ANTARES FACILITY*
*FEED MATERIALS PLANTS*
*FUEL FABRICATION PLANTS*
*FUEL REPROCESSING PLANTS*
**IAEA Safeguards**
Goals of measurement systems for international safeguards, 6:21713
**Sabotage**
Tamper recorder for unattended safeguards instruments, 6:21705
**Safeguards**
Goals of measurement systems for international safeguards, 6:21713
**NUCLEAR FUELS**
*See also LIQUID FUELS*
*SPENT FUELS*
**Nondestructive Analysis**
Nondestructive, energy-dispersive, x-ray fluorescence analysis of product stream concentrations from reprocessed nuclear fuels, 6:21647
**X-Ray Fluorescence Analysis**
Demonstration of totally sampled wavelength dispersive XRF for use in the assay of the SNM content of dissolver solutions, 6:22354
**NUCLEAR INDUSTRY**
**Forecasting**
International uranium market, 6:21651 (MIT-EL—80-014)
**NUCLEAR MATERIALS DIVERSION**
**Neutron Detection**
Active neutron technique for detecting attempted special nuclear materials diversion, 6:21710
**NUCLEAR MATERIALS MANAGEMENT**
**Accounting**
Materials accounting considerations for international safeguards in a light-water reactor fuels reprocessing plant, 6:21715
Materials measurement and accounting in an operating plutonium conversion and purification process. Phase I. Process modeling and simulation, 6:21694 (LA—8809-MS)
**Domestic Safeguards**
Inventory verification methods in DOE safeguards inspections, 6:21704
**IAEA Safeguards**
Goals of measurement systems for international safeguards, 6:21713
**Isotope Ratio**
Quadrupole mass spectrometer for a mobile laboratory to measure isotope ratios, 6:21693 (CONF-810548—3)
**Meetings**
Measurement technology for safeguards and materials control, proceedings from American Nuclear Society Topical Meeting, 1979, 6:21700
**Nondestructive Analysis**
Inspector-instrument interface in portable NDA instrumentation, 6:21695 (LA-UR—81-1402)
**Personnel Monitoring**
Passive nuclear material detection in a personnel portal, 6:21709
**Quality Assurance**
Reference materials and measurement traceability, 6:21701
**Radiometric Analysis**
CAMAC gamma ray scanning system, 6:21697 (LA-UR—81-1512)
**Safeguards**
Goals of measurement systems for international safeguards, 6:21713
**Standards**
Preparation of prototype NDA reference materials: a progress report, 6:21702
**NUCLEAR MATTER**
**Equations of State**
Nuclear equation of state studied with high-energy heavy ions, 6:22854 (LA-UR—81-1555)
**NUCLEAR PHYSICS**
**Research Programs**
Nuclear science. Annual report, July 1, 1979-June 30, 1980, 6:22844 (LBL—11588)
**NUCLEAR POWER PLANTS**
**Cost Benefit Analysis**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**Environmental Impact Statements**
Final environmental impact statement. Construction of Pebble Springs Nuclear Plant, Units 1 and 2 (supplement), 6:22605
Final environmental impact statement. River Bend Nuclear Power Station Unit 1, 6:22607
**Pressure Vessels**
Class 1 nuclear components (supplement to ASME Boiler and Pressure Vessel Code, Section III, Subsections NCA and NB), 6:22045 (NE-E—15-2NB-T(Rev.)(1-81))
**Productivity**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**Reactor Maintenance**
Application of pattern recognition techniques to a flying robotic arm, 6:22024
**Regulations**
Power plant productivity improvement in New York, 6:22133 (DOE/RG/06668—T1)
**Remote Handling Equipment**
Application of pattern recognition techniques to a flying robotic arm, 6:22024
**Research Programs**
1981-1985 research and development program plan: program descriptions, 6:22134 (EPRI-P—1726-SR)
**Risk Assessment**
Some notable probability and statistics problems encountered in risk analysis applications, 6:22070 (CONF-791016—)
**Spent Fuel Storage**
Commercial US nuclear reactors and waste: the status, December 1980, 6:21682 (PNL-SA—9231)
**Steam Generators**
Class 1 nuclear components (supplement to ASME Boiler and Pressure Vessel Code, Section III, Subsections NCA and NB), 6:22045 (NE-E—15-2NB-T(Rev.)(1-81))
**NUCLEAR REACTIONS**
*See also THERMONUCLEAR REACTIONS*
Compilation of requests for nuclear data, 6:22843 (DOE/NDC—22/U)

**NUCLEAR WASTES**
*See RADIOACTIVE WASTES*
**NUCLEAR WEAPON TESTS**
*See NUCLEAR EXPLOSIONS*
**NUCLEAR WEAPONS**
**Diagnostic Techniques**
EG and G support to LLNL, 1 January 1981-31 March 1981, 6:22528 (EGG—1183-4221)
**Performance Testing**
EG and G support to LLNL, 1 January 1981-31 March 1981, 6:22528 (EGG—1183-4221)
**NUCLEI (CELLS)**
*See CELL NUCLEI*
**NUTS**
*See FASTENERS*

## O

**OAK RIDGE GASEOUS DIFFUSION PLANT**
*See ORGDP*
**OAK RIDGE NATIONAL LABORATORY**
*See ORNL*
**OBESITY**
*See METABOLIC DISEASES*
**OCEAN THERMAL ENERGY CONVERSION**
**Program Management**
OTEC support services. Quarterly technical progress report No. 12, 15 February-14 May 1981, 6:21842 (DOE/ET/21002—T14)
**Research Programs**
Ocean energy conversion systems annual research report, 6:21843 (SERI/TR—634-1011)
**Technology Assessment**
Electric power generation: ocean thermal energy conversion, 6:21844
**Thermodynamic Cycles**
Ocean energy conversion systems annual research report, 6:21843 (SERI/TR—634-1011)
**OCEAN THERMAL POWER PLANTS**
**Heat Exchangers**
Test results of heat-exchanger cleaning in support of ocean thermal energy conversion, 6:21841 (DOE/CH/00135—3)
**OCEANIA**
**Geothermal Resources**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)
**OCEANOGRAPHY**
Solar ponds, 6:21943 (LA—8797-PR)
**OECD**
*(Organization of Economic Co-operation and Development.)*
*See also AUSTRALIA*
*CANADA*
*ITALY*
*JAPAN*
*NEW ZEALAND*
*UNITED KINGDOM*
*USA*
**Energy Consumption**
Progress in residential energy conservation: a multi country perspective, 6:22206 (LBL—11701)
**OFFICE BUILDINGS**
**Air Infiltration**
Building infiltration, 6:22176 (CONF-8003114—)
**Energy Analysis**
Passive solar retrofit of all glass office buildings, 6:21897
**Energy Losses**
Building infiltration, 6:22176 (CONF-8003114—)
**Shading**
Passive solar retrofit of all glass office buildings, 6:21897
**Solar Space Heating**
Passive solar retrofit of all glass office buildings, 6:21897
**OFF-PEAK ENERGY STORAGE**
**Performance**
Use of the atop system in the control of an off-peak storage device, 6:22221
**Thermal Energy Storage Equipment**
Technical and financial aspects of electric utility peak load reduction through solar space heating system controls, 6:21931
**OHIO STATE UNIVERSITY REACTOR**
*See OSUR REACTOR*
**OIL FIELDS**
**Oil Saturation**
Residual-oil-saturation-technology test, Bell Creek Field, Montana. Final report, 6:21572 (DOE/ET/12366—22)
**OIL RESIDUES**
*See PETROLEUM RESIDUES*
**OIL SANDS**
**Enhanced Recovery**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)
**OIL SHALE MINING**
*See also SURFACE MINING*
*UNDERGROUND MINING*
**Waste Water**
Wastewater treatment in the oil-shale industry, 6:21615 (LBL—11214)
**OIL SHALE PROCESSING PLANTS**
**Retorts**
Thermomechanics, 6:22037 (LA—8797-PR)
**Waste Water**
Wastewater treatment in the oil-shale industry, 6:21615 (LBL—11214)
**OIL SHALES**
*See also BLACK SHALES*
**Cracks**
Explosively produced fracture of oil shale, July-September 1979, 6:21607 (LA—8397-PR)
**Enhanced Recovery**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)
**Explosive Fracturing**
Explosively produced fracture of oil shale, July-September 1979, 6:21607 (LA—8397-PR)
**In-Situ Retorting**
Investigation of the geokinetics horizontal in situ oil shale retorting process. Quarterly report, January, February, March 1981, 6:21608 (DOE/LC/10787—77)
Oil shale program. Twentieth quarterly report, October 1980-December 1980, 6:21610 (SAND—81-1038)
Ultrasonic thermometry in oil shale retorts, 6:21612 (UCRL—85845)
**Modified In-Situ Processes**
Multistage leaching of spent modified in situ oil shale retorts, 6:21609 (LA—8744-MS)
**Mutagen Screening**
Studies of the biology and toxicology of oilshale materials, 6:22705 (LA-UR—81-1166)
**Retorting**
Why solar oil shale retorting produces more oil, 6:21611 (UCID—19045)
**Toxicity**
Studies of the biology and toxicology of oilshale materials, 6:22705 (LA-UR—81-1166)
**OIL WELLS**
*See also PETROLEUM*
**Carbon Dioxide Injection**
Displacement of oil by carbon dioxide. Final report, 6:21571 (DOE/ET/12082—9)
**Fluid Injection**
Two-dimensional temperature distribution surrounding an injection well, 6:21573 (SAND—81-0101C)
**In-Situ Combustion**
In-situ combustion models for the steam plateau and for fieldwide oil recovery, 6:21570 (DOE/ET/12056—11)
**Phase Studies**
Displacement of oil by carbon dioxide. Final report, 6:21571 (DOE/ET/12082—9)
**OOCYTES**
*See OVA*

**OPEC**
*(Organization of Petroleum Exporting Countries.)*
**Economic Impact**
Effect of OPEC oil pricing on output, prices, and exchange rates in the United States and other industrialized countries, 6:21588
**OPTICAL MODELS**
**Potential Scattering**
Doorway state approach to optical potential scattering, 6:22855
**OPTICAL RADAR**
**Feasibility Studies**
Review of remote-sensor potential for wind-energy studies, 6:21983 (DOE/ET/23151—80/1)
**OPTICAL SYSTEMS**
**Coatings**
Reactively sputtered oxide optical coatings for inertial confinement fusion laser components, 6:22958
**ORBITAL SOLAR POWER PLANTS**
Examination of some hypothetical SPS rectenna sites within the contiguous United States of America. Part I. Precipitation effects on hypothetical SPS sites in the USA. Part II. Point-to-point microwave and service mode communications systems near four hypothetical SPS rectenna sites in the continental United States, 6:21812 (DOE/ER/10160—T4)
**Bibliographies**
Solar photovoltaics: a bibliography with abstracts, 6:21795 (TAC/SP—80-004)
**Comparative Evaluations**
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**Environmental Impacts**
SPS ionosphere/microwave beam interactions: Arecibo experimental studies, 6:21752 (LA-UR—80-3095)
**Microwave Power Transmission**
SPS susceptible-system cost factors investment summary and mitigation-cost-increment estimates, 6:21751 (DOE/ER/10160—T3)
**Technology Assessment**
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**ORE PROCESSING**
**Health Hazards**
Mortality among men employed between 1943 and 1947 at a uranium-processing plant, 6:22695
**OREGON**
**Geology**
Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: an update, 6:21957 (USGS-OFR—80-490)
**Geothermal Resources**
Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: an update, 6:21957 (USGS-OFR—80-490)
**Households**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**ORGANIC CHLORINE COMPOUNDS**
*See also CHLORINATED ALIPHATIC HYDROCARBONS*
*CHLORINATED AROMATIC HYDROCARBONS*
*PVC*
**Hot Atom Chemistry**
Reactions of recoil $^{38}Cl$ in crystalline p-dichlorobenzenes, 6:22409
**ORGANIC COMPOUNDS**
*See also ALDEHYDES*
*AMINES*
*CARBONIC ACID DERIVATIVES*
*HETEROCYCLIC COMPOUNDS*
*HYDROCARBONS*
*KETONES*
*ORGANIC PHOSPHORUS COMPOUNDS*
*ORGANIC POLYMERS*
*ORGANIC SULFUR COMPOUNDS*
*ORGANOMETALLIC COMPOUNDS*
*PROTEINS*
**Biodegradation**
Biodegradation tests: use and value, 6:22362
Biotransformation and fate of chemicals in the aquatic environment (Lead abstract), 6:22582
Modeling the environmental fate of synthetic organic chemicals, 6:22590
Quantitative expression of biotransformation rate, 6:22591
**Chemical Analysis**
Bio/organic analysis section, 6:22334 (ORNL—5738)
**Environmental Transport**
Modeling the environmental fate of synthetic organic chemicals, 6:22590
**ORGANIC MATTER**
*See also KEROGEN*
*PEAT*
**Environmental Transport**
Fluxes of organic matter in rivers relative to the global carbon cycle, 6:22567 (CONF-8009140—)
**ORGANIC PHOSPHORUS COMPOUNDS**
**Catalysis**
Phosphorus-31 nuclear magnetic resonance as a method of predicting ligand basicity and rates of homogeneous catalysis, 6:22387
**Nuclear Magnetic Resonance**
Phosphorus-31 nuclear magnetic resonance as a method of predicting ligand basicity and rates of homogeneous catalysis, 6:22387
**Structural Chemical Analysis**
Phosphorus-31 nuclear magnetic resonance as a method of predicting ligand basicity and rates of homogeneous catalysis, 6:22387
**ORGANIC POLYMERS**
*See also COPOLYMERS*
*GRAFT POLYMERS*
*PLASTICS*
**Chemical Radiation Effects**
Reaction with metal ions of chloromethylated polystyrene resin containing dithiocarbamate group, 6:22404
**Chemical Reactions**
Reaction with metal ions of chloromethylated polystyrene resin containing dithiocarbamate group, 6:22404
**Comparative Evaluations**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**Radiolysis**
Effects of ionizing radiation on perfluorosulfonic acid ion-exchange polymer (Nafion), 6:22308
**ORGANIC SULFUR COMPOUNDS**
*See also PHENOTHIAZINES*
*SULFONATES*
**Flame Photometry**
Determination of sulfur heterocycles in coal liquids and shale oils, 6:21537
**Gas Chromatography**
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
**Mass Spectroscopy**
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
**Mutagen Screening**
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
**Synthesis**
Identification of sulfur heterocycles in coal liquids and shale oils. Technical progress report, August 1, 1980-May 1, 1981, 6:21501 (DOE/EV/10237—2)
**ORGANOMETALLIC COMPOUNDS**
**Chemical Preparation**
Organochromium(III) complexes derived from nitriles, 6:22388
**Chemical Reactions**
Organochromium(III) complexes derived from nitriles, 6:22388

**ORGDP**
*(Oak Ridge Gaseous Diffusion Plant.)*
**Energy Conservation**
UCC-ND engineering program, 6:22171 (CONF-8003114—)
**ORNL**
*(Oak Ridge National Laboratory.)*
**Energy Conservation**
ORNL energy conservation management plan, 6:22170 (CONF-8003114—)
UCC-ND engineering program, 6:22171 (CONF-8003114—)
**Energy Management Systems**
ORNL energy conservation management plan, 6:22170 (CONF-8003114—)
ORNL Energy Management System, 6:22173 (CONF-8003114—)
**OROTIC ACID**
**Radiation Chemistry**
ESR study of DNA base cation radicals produced by attack of oxidizing radicals, 6:22405
**OSCILLATORS**
**Design**
Actively mode-locked and Q-switched oscillator system (21 Aug 1980) (Engineering Materials) (Argus), 6:22966 (CAPE—2694)
**Electronic Circuits**
Actively mode-locked and Q-switched oscillator system (21 Aug 1980) (Engineering Materials) (Argus), 6:22966 (CAPE—2694)
**OSMOSIS**
**Brownian Movement**
Brownian motion in a flowing fluid revisited, 6:22815
**Correlations**
Osmoregulation in the Avena coleoptile in relation to auxin and growth, 6:22662
**OSMOTIC POWER PLANTS**
*See SALINITY GRADIENT POWER PLANTS*
**OSUR REACTOR**
**Research Programs**
Ohio State University reactor sharing program. Progress report, September 1, 1980-April 30, 1981, 6:22058 (DOE/ER—10727)
**OTEC**
*See OCEAN THERMAL ENERGY CONVERSION*
**OTEC POWER PLANTS**
*See OCEAN THERMAL POWER PLANTS*
**OUTAGES**
**Data Analysis**
Analysis of bulk-power-system failures and review of utility security and restoration procedures, 6:22011 (DOE/EP—0005)
**OUTER CONTINENTAL SHELF**
*See CONTINENTAL SHELF*
**OVA**
**Ultrastructural Changes**
Initial stages of sperm penetration into the egg of Fundulus heteroclitus, 6:22657
**OVARIES**
**Biological Radiation Effects**
Radiation effects on brain weight and gonad weight in Segment II beagles, 6:22689 (FDA—81-8042)
**OVERHEAD POWER TRANSMISSION**
**Environmental Impact Statements**
Final environmental impact statement. Emery 2 (Hunter 2) Utah Power and Light Company generating station and related transmission facilities, 6:22603
**OXALIC ACID**
**Electron Spectra**
Photoelectron spectroscopy of carbonyls: saturated normal dicarboxylic acids, 6:22382
**OXIDES**
**Chemical Reactions**
Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis, 6:22408
**OXIRANS**
*See EPOXIDES*
**OXYGEN**
**Adsorption**
Oxidation of Si(111), 7 x 7 and 2 x 1: A comparison, 6:22323
**Atom-Molecule Collisions**
Classical trajectory models for electronically nonadiabatic collision processes: A classical valence bond model for electronic degrees of freedom, 6:22801
**Chemical Reaction Kinetics**
Characterization of the selective reduction of NO by $NH_3$, 6:22465 (LBL—12215)
**Chemical Reactions**
Chemical information from Auger electron spectroscopy, 6:22348
Critical conditions for the growth of SiC, $Si_bN_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981, 6:22295 (DOE/ER/10438—T1)
**Chemisorption**
Two-dimensional chemisorbed phases, 6:22287
**Diffusion**
Point defects in uranium dioxide, 6:22297 (LBL—12548)
**Electron-Molecule Collisions**
New, optically forbidden Rydberg series in $O_2$ converging to the $O^+_2$ c $^4S^-$/sub u/ limit, 6:22800
**Forbidden Transitions**
New, optically forbidden Rydberg series in $O_2$ converging to the $O^+_2$ c $^4S^-$/sub u/ limit, 6:22800
**Gettering**
Oxygen getter coatings for fission reactor fuel pins, 6:22055
**Ignition**
Strong ignition limits for methane-hydrogen mixtures, 6:21727 (LBL—12146)
**Matrix Isolation**
Matrix interactions with rare-gas oxide excimers, 6:22747
**OXYGEN 16**
**E2-Transitions**
Evidence for giant E2 transitions in high-energy a-particle capture, 6:22848
**OXYGEN 17**
**Alpha Reactions**
870.8-keV gamma ray from $PuO_2$, 6:21696 (LA-UR—81-1510)
**Neutron Reactions**
870.8-keV gamma ray from $PuO_2$, 6:21696 (LA-UR—81-1510)
**OXYGEN 18**
**Alpha Reactions**
870.8-keV gamma ray from $PuO_2$, 6:21696 (LA-UR—81-1510)
**Neutron Reactions**
870.8-keV gamma ray from $PuO_2$, 6:21696 (LA-UR—81-1510)
**OXYGEN COMPOUNDS**
**Bending**
High temperature applications of structural ceramics. Quarterly progress report, January-March 1981, 6:22296 (DOE/OR/20679—T4)
**OXYGEN EFFECT (RADIOBIOLOGY)**
*See OXYGEN*
**OXYGEN IONS**
**Collisions**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**Ion-Atom Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**Ion-Ion Collisions**
Theoretical study of electron capture in ion-ion and ion-atom collisions. Progress report, September 1, 1980-April 30, 1981, 6:22773 (DOE/ER/10749—1)
**OZONE**
**Atmospheric Chemistry**
Effect of temperature feedback and hydrostatic adjustment in a stratospheric model, 6:22548
**Ecological Concentration**
Comparison of observed and model-predicted $O_3$ trends, 6:22547 (UCID—19040)
**Monitoring**
Mobile source emission inventory, 6:22544 (EPA-AA-TEB—81-11)

# P

**PACIFIC ISLANDS**
*See OCEANIA*

**PACIFIC NORTHWEST REGION**
*See also ALASKA*
*IDAHO*
*OREGON*
*WASHINGTON*

**Degree Days**
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))

**Energy Consumption**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))

**PALLADIUM SULFIDES**

**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581

**PARABOLIC TROUGH COLLECTORS**

**Cleaning**
Cleaning strategies for parabolic-trough solar-collector fields; guidelines for decisions, 6:21948 (SAND—81-0385)

**Control Systems**
Power-cable-carrier control ($PC^3$) system, 6:21839 (SAND—81-0113)

**Design**
Analytical studies of a parabolic line concentrator utilizing an aluminum honeycomb support structure and a thin glass reflector laminate, 6:21945 (SAND—80-1583)

**Mathematical Models**
Experimental parabolic trough collector performance characterization, 6:21947 (SAND—81-0313)

**Performance**
Analytical studies of a parabolic line concentrator utilizing an aluminum honeycomb support structure and a thin glass reflector laminate, 6:21945 (SAND—80-1583)
Experimental parabolic trough collector performance characterization, 6:21947 (SAND—81-0313)

**Performance Testing**
Focusing solar air heater with rock storage, 6:21951

**PARACHUTES**

**Motion**
Utilization of hybrid computational equipment for the simulation of parachute system flight, 6:22427 (SAND—80-2549C)

**Trajectories**
Utilization of hybrid computational equipment for the simulation of parachute system flight, 6:22427 (SAND—80-2549C)

**PARAFFIN**

**Mass Spectroscopy**
Hydrocarbon type analysis of jet fuels by $^{1}H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)

**NMR Spectra**
Hydrocarbon type analysis of jet fuels by $^{1}H$ and $^{13}C$ NMR, 6:21593 (DOE/LETC/RI—81-1)

**PARAFFINS**
*See ALKANES*

**PARASITES**
*See also VIRUSES*

**Infectivity**
Parasite fauna of the American alligator (Alligator mississippiensis) in South Carolina, 6:22659

**PARKS (INDUSTRIAL)**
*See INDUSTRIAL PARKS*

**PARTICLE DECAY**

**CP Invariance**
Phenomenology of quark mixing and the Kobayashi-Maskawa model, 6:22822 (BNL—29468)

**PARTICLE INTERACTIONS**
*See also LEPTON-HADRON INTERACTIONS*

**Renormalization**
How super-renormalizable interactions cure their infrared divergences, 6:22827

**PARTICLE SIZE**

**Measuring Methods**
Particle size measurements using an optical variable-frequency-grid technique, 6:22282

**PARTON MODEL**

**Lepton-Hadron Interactions**
Intuitive approach to a generalized parton picture for high-energy lepton—hadron scattering, 6:22831

**Scale Invariance**
Intuitive approach to a generalized parton picture for high-energy lepton—hadron scattering, 6:22831

**PARTURITION**

**Biological Radiation Effects**
Effect of radiation on gestation periods in dams of Segment III beagles, 6:22684 (FDA—81-8042)

**Temperature Effects**
Effect of radiation on gestation periods in dams of Segment III beagles, 6:22684 (FDA—81-8042)

**PASSIVE SOLAR COOLING SYSTEMS**
*See also ROOF PONDS*

**Data Acquisition Systems**
PDL-24 solar monitoring system, 6:21909

**Demonstration Programs**
Strategies for the use of passive solar approaches in commercial buildings, 6:21896

**Design**
Passive solar retrofit of all glass office buildings, 6:21897

**Economics**
Bottom line: comments on incremental costs in the Massachusetts multi-family passive solar housing program, 6:21903

**Education**
Passive education for active professionals: a review of the effectiveness of the passive studio, 6:21891

**Heat Transfer**
Heat transfer in passively cooled buildings, 6:21886

**Indoor Air Pollution**
Indoor air pollution in passive structures, 6:21902

**Manufacturing**
Passive solar manufactured buildings program: useful model for government efforts to assist industry, 6:21900

**Meetings**
5th national passive solar conference, 6:21885

**Program Management**
Strategies for the use of passive solar approaches in commercial buildings, 6:21896

**Radiative Cooling**
Measurements and simulations of radiative cooling through IR transparent windscreens, 6:21888

**Radiators**
Measurements and simulations of radiative cooling through IR transparent windscreens, 6:21888

**Retrofitting**
Passive solar retrofit of all glass office buildings, 6:21897

**Roof Ponds**
Validation of heat transfer coefficients for passive cooling, 6:21930

**Simulation**
Passive nocturnal cooling resource assessment using validated heat transfer equations, 6:21889

**Surveys**
International passive architectural survey: preliminary analysis, 6:21923

**Thermal Comfort**
Comfort conditions in roof pond cooled residences without air conditioners, 6:21911

**PASSIVE SOLAR HEATING SYSTEMS**
*See also DIRECT GAIN SYSTEMS*

*ROOF PONDS*
*TROMBE WALLS*
Massachusetts multi-family passive solar housing program, 6:21913
**Auxiliary Heating**
Eliminating peak load auxiliary energy use in passive solar residences during winter, 6:21924
**Computer Calculations**
F-Chart/SLR: an interactive program for determining the performance of active and passive solar buildings, 6:21926
Human comfort and auxiliary control considerations in passive solar structures, 6:21921
**Computer Codes**
SOLPAS: passive solar algorithms. User's manual, 6:21863 (MCR—81-543)
**Data Acquisition Systems**
PDL-24 solar monitoring system, 6:21909
**Demonstration Programs**
Design of passive commercial buildings: major lessons learned, 6:21895
Solar cities and towns program, 6:21893
Strategies for the use of passive solar approaches in commercial buildings, 6:21896
**Design**
Genesis: the solar community, 6:21901
Moving passive into the mass market: the Acorn/Massdesign passive prototype, 6:21898
Passive solar retrofit of all glass office buildings, 6:21897
Passive Solar Systems, 6:21861 (LA—8797-PR)
Solar project description for Helio-Thermics, Inc., Lot 6 single family residence; Greenville, South Carolina, 6:21874 (SOLAR/1025—81/50)
Wall collector design analysis: project status report No. 2. Hing/daylighting prototype development, Phase I, 6:21849 (DOE/CS/30367—4)
**Economic Impact**
Ecomomic implications of a passive solar retrofit program in Albuquerque, New Mexico, 6:21894
**Economics**
Bottom line: comments on incremental costs in the Massachusetts multi-family passive solar housing program, 6:21903
**Education**
Passive education for active professionals: a review of the effectiveness of the passive studio, 6:21891
**Energy Analysis**
Human comfort and auxiliary control considerations in passive solar structures, 6:21921
**Hybrid Systems**
Solar cities and towns program, 6:21893
Wall collector design analysis: project status report No. 2. Hing/daylighting prototype development, Phase I, 6:21849 (DOE/CS/30367—4)
**Indoor Air Pollution**
Indoor air pollution in passive structures, 6:21902
**Manufacturing**
Passive solar manufactured buildings program: useful model for government efforts to assist industry, 6:21900
**Marketing Research**
Preliminary market potential indexing study of the United States for direct gain in new single-family residential construction, 6:21746 (LA-UR—81-1201)
**Meetings**
5th national passive solar conference, 6:21885
**Monitoring**
Suncatcher monitoring project. Semi-annual technical report, July-December 1980, 6:21846 (DOE/CS/30169—6)
**Natural Convection**
Natural convection in room geometries, 6:21920
**Performance**
Analysis and performance evaluation of an air thermosyphon system, 6:21908
Graphic passive design tools for annual performance in the Northeast, 6:21928
Passive Solar Systems, 6:21861 (LA—8797-PR)
Performance summary of the Balcomb solar home, 6:21862 (LA-UR—81-1039)
Predicted performance of the KSU solar collector-storage system, 6:21881
Prediction of the performance of passive heating systems using the base-temperature method of performance prediction, 6:21927
Qualitative approach to performance evaluation of passive solar residences, 6:21910
**Program Management**
Strategies for the use of passive solar approaches in commercial buildings, 6:21896
**Public Relations**
Overcoming the non-technical barriers to the acceptance and utilization of passive solar energy through education and promotional activities, 6:21892
**Retrofitting**
Ecomomic implications of a passive solar retrofit program in Albuquerque, New Mexico, 6:21894
Passive solar retrofit of all glass office buildings, 6:21897
**Simulation**
Analysis and performance evaluation of an air thermosyphon system, 6:21908
**Surveys**
International passive architectural survey: preliminary analysis, 6:21923
**Thermal Analysis**
Graphic passive design tools for annual performance in the Northeast, 6:21928
Natural convection in room geometries, 6:21920
**PASSIVE SOLAR WATER HEATERS**
**Design**
Design and installation considerations for refrigerant charged thermosyphoning solar DHW systems, 6:21917
Solar project description for Helio-Thermics, Inc., Lot 6 single family residence; Greenville, South Carolina, 6:21874 (SOLAR/1025—81/50)
**Performance**
Performance of solar energy hot water systems, 6:21868 (SOLAR/0005—81/80)
**PCB**
*See CHLORINATED AROMATIC HYDROCARBONS*
**PDU**
*See PROCESS DEVELOPMENT UNITS*
**PEAT**
**Anaerobic Digestion**
Continued development of a peat biogasification process, 6:21520
Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
**Bioconversion**
Peat as an energy alternative, 6:21547
**Briquetting**
Peat as an energy alternative, 6:21547
**Calorific Value**
Peat as an energy alternative, 6:21547
**Carbonization**
Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
**Chemical Reaction Kinetics**
DOE program for the development of a peat utilization technology, 6:21528
**Combustion Properties**
Pilot plant tests of peat for direct combustion in utility boilers, 6:21563
**Dissolution**
Continued development of a peat biogasification process, 6:21520
**Drying**
Peat as an energy alternative, 6:21547
**Gasification**
Continued development of a peat biogasification process, 6:21520
DOE peat program, 6:21521
Peat as an energy alternative, 6:21547

**Hydrolysis**
Continued development of a peat biogasification process, 6:21520
**Liquefaction**
Peat as an energy alternative, 6:21547
**Market**
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))
**Marketing Research**
Low-rank coal study: national needs for resource development. Volume 6. Peat, 6:21544 (DOE/FC/10066—T1(Vol.6))
**Meetings**
Peat as an energy alternative, 6:21547
**Oxidation**
Continued development of a peat biogasification process, 6:21520
Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
**Research Programs**
DOE program for the development of a peat utilization technology, 6:21528
Low-rank coal study: national needs for resource development. Volume 6. Peat, 6:21544 (DOE/FC/10066—T1(Vol.6))
**Reserves**
Michigan's organic soils - an immense untapped energy resource, 6:21548
Peat resource estimation project in Minnesota, 6:21549
Peat resources of South Carolina, 6:21550
**Resource Assessment**
Low-rank coal study: national needs for resource development. Volume 6. Peat, 6:21544 (DOE/FC/10066—T1(Vol.6))
Maine peat resource evaluation program, 6:21551
**Surface Mining**
DOE peat program, 6:21521
Environmental issues and strategies for peat energy development in the US, 6:21565
Peat as an energy alternative, 6:21547
Peatland reclamation - the energy crop option, 6:21553
**Water Removal**
Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
Peat as an energy alternative, 6:21547

**PEATGAS PROCESS**
SNG from peat by the PEATGAS process, 6:21531
**Mathematical Models**
Peatgas process development status, 6:21518
**Process Development Units**
Peatgas process development status, 6:21518

**PEBBLE BED REACTORS**
**Design**
Pebble Bed Reactor Plant screening evaluation. Volume 1. Overall plant and reactor system (300 MW(t) Multiplex plant), 6:22047 (DOE/ET/35202—T1(Vol.1))

**PELVIS**
**Ultrasonography**
Experiences using B scanning techniques in the dog, 6:22645 (FDA—81-8042)

**PENNSYLVANIA**
**Black Shales**
Stratigraphic cross section of the upper Devonian Perrysburg and Java formations and thier equivalents, Northwestern Pennsylvania, 6:21598 (METC/EGSP—14)
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)

**PENTANE**
**Phase Studies**
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576

**PEP STORAGE RINGS**
*(Positron-electron-proton storage ring.)*
**Beam Bunching**
Operation of PEP longitudinal feedback system, 6:22471 (SLAC-PUB—2670)
**Beam Dynamics**
Operation of the PEP transverse beam feedback, 6:22477 (SLAC-PUB—2690)
Optical beam diagnostics on PEP, 6:22475 (SLAC-PUB—2683)
PEP storage ring: current status, 6:22497 (SLAC-PUB—2684)
**Beam Luminosity**
Luminosity monitor at PEP, 6:22499 (SLAC-PUB—2691)
**Beam Monitoring**
Optical beam diagnostics on PEP, 6:22475 (SLAC-PUB—2683)
**Beam Monitors**
Operation of PEP longitudinal feedback system, 6:22471 (SLAC-PUB—2670)
**On-Line Control Systems**
Some schemes for on-line correction of the closed orbit, dispersion and beta functions in PEP, 6:22470 (SLAC-PUB—2666)
**Performance**
PEP storage ring: current status, 6:22497 (SLAC-PUB—2684)
**RF Systems**
Control electronics of the PEP RF system, 6:22493 (SLAC-PUB—2664)
**Safety Engineering**
Radiation and electrical safety systems for PEP, 6:22494 (SLAC-PUB—2675)

**PEPTIDE HYDROLASES**
**Electrophoresis**
Electrophoretic variants in three Amerindian tribes: the Baniwa, Kanamari, and central Pano of western Brazil, 6:22640

**PERSONNEL**
**Epidemiology**
General statistical data structure for epidemiologic studies of DOE workers, 6:22671 (CONF-801045—)
Proceedings of the 1980 DOE statistical symposium (Lead Abstract), 6:22538 (CONF-801045—)

**PERSONNEL DOSIMETRY**
**Statistical Models**
Calibration of personnel radiation measurement instruments, 6:22510 (CONF-801045—)

**PESTICIDES**
**Biodegradation**
Use of a microcosm approach to assess pesticide biodegradability, 6:22593
**Environmental Transport**
Water: pesticides in ground water beneath irrigated farmland in Nebraska, August 1978, 6:22583

**PETROLEUM**
*See also OIL WELLS*
*SHALE OIL*
*WELL STIMULATION*
**Combustion**
Regional and national NO/sub x/ emissions, 6:22537 (ANL/EES-TM—130)
**Phase Studies**
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576
**Prices**
Effect of OPEC oil pricing on output, prices, and exchange rates in the United States and other industrialized countries, 6:21588
NBER working paper series: oil and the dollar. Working Paper No. 554, 6:21589
**Production**
Analysis of cumulative crude oil discovery and production, 6:22127
**Regulations**
Regulatory impact an oil development (From 1980 Mineral Economics Symposium), 6:22125

**Resource Conservation**
Air quality analysis of Phase I of the proposed oil backout legislation: Introduction, 6:22229 (ANL/EES-TM—130)
**Taxes**
Capturing oil rents with a national excise tax. Summer Institute paper No. 80-3, 6:22126
**PETROLEUM DEPOSITS**
*See also OIL FIELDS*
**Forecasting**
Analysis of a statistical model to predict future oil, 6:21568 (CONF-791016—)
**Leases**
United States Depratment of the Interior final environmental impact statement, 6:21590
**PETROLEUM INDUSTRY**
**Legislation**
Petroleum refining industry in the 1980s: impact of the National Energy Plan and related legislation, 6:21591 (ORAU/IEA—81-3(M))
**National Energy Plan**
Petroleum refining industry in the 1980s: impact of the National Energy Plan and related legislation, 6:21591 (ORAU/IEA—81-3(M))
**PETROLEUM RESIDUES**
**Coking**
Chemical physics of catalysis. Residium upgrading and coking. Chemistry of engine combustion deposits, 6:21582
**Refining**
Chemical physics of catalysis. Residium upgrading and coking. Chemistry of engine combustion deposits, 6:21582
**PH VALUE**
**Mathematical Models**
pH buffering of pore water of recent anoxic marine sediments, 6:22575
**PHENOLS**
*See also CRESOLS*
**Distillation**
Material balance approach to estimating aquatic exposure concentrations, 6:22587
**PHENOTHIAZINES**
*See also METHYLENE BLUE*
**Desulfurization**
Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980, 6:21494 (DOE/ET/11429—T1)
**PHORBOL ESTERS**
**Side Effects**
Variants of 3T3 cells lacking mitogenic response to the tumor promoter tetradecanoyl-phorbol-acetate, 6:22632
**PHOSPHINES**
**Catalysis**
Phosphorus-31 nuclear magnetic resonance as a method of predicting ligand basicity and rates of homogeneous catalysis, 6:22387
**Nuclear Magnetic Resonance**
Phosphorus-31 nuclear magnetic resonance as a method of predicting ligand basicity and rates of homogeneous catalysis, 6:22387
**PHOSPHORUS**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**PHOSPHORUS IONS**
**Lamb Shift**
Precision determinations of high Z hydrogenic ion Lamb shifts, 6:22761 (ANL—80-126)
**PHOTODETECTORS**
**Performance**
High-speed photodetector for plasma diagnostics, 6:22879 (LA-UR—81-1028)
**PHOTOELECTROCHEMICAL CELLS**
**Electrodes**
Laser-induced photoelectrochemistry. Time-resolved coulostatic-flash studies of cadmium sulfide electrodes, 6:21797
**Photochemistry**
Laser-induced photoelectrochemistry. Time-resolved coulostatic-flash studies of cadmium sulfide electrodes, 6:21797
**Reviews**
Principles of photoelectrochemical, solar energy conversion, 6:21798
**PHOTON DETECTION (GAMMA)**
*See GAMMA DETECTION*
**PHOTON-MOLECULE COLLISIONS**
**Dissociation**
Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)
**PHOTOSYNTHESIS**
**Chemical Reaction Kinetics**
Electron transfer reactions in cofacial diporphyrins, 6:22626
**Sensitivity**
Effects of $SO_2$ dosage kinetics and exposure frequency on photosynthesis and transpiration of kidney beans (Phaseolus vulgaris L.), 6:22712
**PHOTOSYNTHETIC MEMBRANES**
**Topography**
Phycobilisome-thylakoid topography on photosynthetically active vesicles of Porphyridium cruentum, 6:22661
**PHOTOVOLTAIC CELLS**
*See also COMBINED COLLECTORS*
*SOLAR CELLS*
**National Program Plans**
DOE perspective on photovoltaics development, 6:21825
Overview of the National Photovoltaics Program, 6:21799
Overview of photovoltaic collector technology status and objectives, 6:21800
**PHOTOVOLTAIC CONVERSION**
**Economics**
Technological and economic development of photovoltaics (Review), 6:21806
**Technology Assessment**
Technological and economic development of photovoltaics (Review), 6:21806
**PHOTOVOLTAIC POWER PLANTS**
*See also SOLAR CELL ARRAYS*
**Bibliographies**
Solar photovoltaics: a bibliography with abstracts, 6:21795 (TAC/SP—80-004)
**Comparative Evaluations**
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**Meetings**
Photovoltaics Program: utility interface southwest regional workshop proceedings, 6:21820 (DOE/ET/20356—2)
**PHOTOVOLTAIC POWER SUPPLIES**
**Bibliographies**
Solar photovoltaics: a bibliography with abstracts, 6:21795 (TAC/SP—80-004)
**Commercialization**
DOE perspective on photovoltaics development, 6:21825
**Comparative Evaluations**
Operational experiences in lead-acid batteries for photovoltaic systems, 6:21813 (DOE/ET/20279—118)
**Data Acquisition Systems**
On-site data acquisition system for photovoltaic applications experiments, 6:21823 (SAND—81-0897)
**Demonstration Programs**
Photovoltaic commercialization: an analysis of legal issues affecting a government-accelerated solar industry, 6:21753 (SERI/TR—434-423)
Review of stand-alone photovoltaic application projects sponsored by US DOE and US AID, 6:21822 (DOE/NASA/20485—8)
**Design**
Residential photovoltaic system designs, 6:21814 (DOE/ET/20279—123)
**Economics**
Effects of government policies on the economic viability of photovoltaic systems, 6:21835
Review of stand-alone photovoltaic application projects sponsored by US DOE and US AID, 6:21822 (DOE/NASA/20485—8)

**Electric Batteries**
Implementation plan (May 1979): batteries for specific solar applications, 6:21773 (SAND—80-0216)
**Flywheel Energy Storage**
Performance characteristics of solar-photovoltaic flywheel-storage systems, 6:21762 (DOE/ET/20279—134)
**Harmonics**
Effect of electrical-utility-system voltage harmonics on induction motors, 6:21819 (DOE/ET/20279—138)
**Institutional Factors**
Photovoltaic commercialization: an analysis of legal issues affecting a government-accelerated solar industry, 6:21753 (SERI/TR—434-423)
**Inverters**
Effect of electrical-utility-system voltage harmonics on induction motors, 6:21819 (DOE/ET/20279—138)
Loss of line shutdown for line-commutated utility-interactive inverter, 6:21815 (DOE/ET/20279—128)
**Lead-Acid Batteries**
Development of a totally maintenance-free, deep-discharge lead-acid battery for photovoltaic applications, 6:22095 (SAND—81-7119C)
Operational experiences in lead-acid batteries for photovoltaic systems, 6:21813 (DOE/ET/20279—118)
**Legal Aspects**
Photovoltaic commercialization: an analysis of legal issues affecting a government-accelerated solar industry, 6:21753 (SERI/TR—434-423)
**Meetings**
Photovoltaics Program: utility interface southwest regional workshop proceedings, 6:21820 (DOE/ET/20356—2)
**National Program Plans**
Overview of the National Photovoltaics Program, 6:21799
**Performance**
Carlisle house: an all-solar electric residence, 6:21817 (DOE/ET/20279—133)
On-site data acquisition system for photovoltaic applications experiments, 6:21823 (SAND—81-0897)
Simplified design methods for photovoltaic systems, 6:21828
**Performance Testing**
Operating experience with the natural bridges national monument photovoltaic power system, 6:21818 (DOE/ET/20279—135)
Residential photovoltaic power systems for the northeast, 6:21816 (DOE/ET/20279—132)
**Research Programs**
Implementation plan (May 1979): batteries for specific solar applications, 6:21773 (SAND—80-0216)
**Reviews**
Local government guide to the emerging technologies of cogeneration and photovoltaics. Energy technology report of the energy task force of the urban consortium, 6:21821 (DOE/IR/05106—T24)

**PHYSIOLOGY**
**Biological Indicators**
Bioindicators of the health of arctic foxes (Alopex lagopus), 6:22660 (PNL-SA—9197)

**PHYTOHEMAGGLUTININ**
**Biological Effects**
Lymphocyte sodium concentration regulates monovalent cation transport after PHA stimulation, 6:22643
Total and exchangeable calcium in mitogen-treated lymphocytes, 6:22644

**PILES**
*See FOUNDATIONS*

**PINES**
**Cultivation Techniques**
Improving tree growth on poor and medium sites through the use of legumes. Annual report, February 14, 1980-September 1, 1980, 6:22670 (DOE/SR/10702—1)

**PINS (FUEL)**
*See FUEL PINS*

**PION MINUS REACTIONS**
**Capture**
Orbital recoupling dominance in the A = 20 isovector giant M1 transition, 6:22849

**PION REACTIONS**
**Low Equation**
Interpretation of some low equation results, 6:22856

**PION-DEUTERON INTERACTIONS**
**Low Equation**
Interpretation of some low equation results, 6:22856

**PION-NUCLEON INTERACTIONS**
**Low Equation**
Interpretation of some low equation results, 6:22856

**PIONS**
**Particle Production**
Exploratory studies on relativistic heavy-ion central collisions, 6:22819

**PIPE JOINTS**
**Stress Analysis**
Simplified inelastic analysis procedure to evaluate a butt-welded elbow end, 6:22034 (CONF-810625—16)

**PIPELINE QUALITY GAS**
*See HIGH BTU GAS*

**PIPELINES**
**Materials**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)

**PIPERAZINES**
**Toxicity**
Mutagenicity of N-nitrosopiperazine derivatives in Saccharomyces cerevisiae, 6:22710

**PLANNED COMMUNITIES**
**Design**
Project planning and design for energy conservation, 6:22219
**Energy Consumption**
Project planning and design for energy conservation, 6:22219
**Solar Energy**
Project planning and design for energy conservation, 6:22219

**PLANT GROWTH**
**Correlations**
Osmoregulation in the Avena coleoptile in relation to auxin and growth, 6:22662

**PLANTS**
*See also ALGAE*
*EUPHORBIA*
*FUNGI*
*GRASS*
*TREES*
**Biodegradation**
Terrestrial sources of organic carbon, 6:22554 (CONF-8009140—)

**PLANTS (INDUSTRIAL)**
*See INDUSTRIAL PLANTS*

**PLASMA**
*See also COLD PLASMA*
*COLLISIONLESS PLASMA*
*INHOMOGENEOUS PLASMA*
*LASER-PRODUCED PLASMA*
*SOLID-STATE PLASMA*
**ECR Heating**
Electron-cyclotron resonance heating in plasmas with arbitrary stratification of the magnetic field, 6:22893
**Guiding-Center Approximation**
Hamiltonian field description of two-dimensional vortex fluids and guiding center plasmas, 6:22884 (PPPL—1783)
**Rotation**
Toroidal plasma rotation in the PLT tokamak with neutral-beam injection, 6:22886 (PPPL—1792)
**Transport Theory**
Verification of the classical theory of helical transport in stellarators, 6:22883 (PPPL—1781)

**PLASMA CONFINEMENT**
*See also INERTIAL CONFINEMENT*
**Computer Codes**
VEPEC: a 3D vector potential equilibrium code for high-beta minimum-B plasma confinement, 6:22888 (UCRL—53099)
**Plasma Instability**
Instability of the Brillouin-flow equilibrium in magnetically insulated structures, 6:22901
**Spheromak Devices**
Compact torus, 6:22903

**Toroidal Configuration**
Compact torus, 6:22903
**PLASMA DIAGNOSTICS**
**Auger Electron Spectroscopy**
Auger analysis of surface deposits formed by exposure to plasma discharges in Doublet III, 6:22900
**Brillouin Effect**
Spectroscopic study of stimulated Brillouin scattering, 6:22896
**Fluorescence Spectroscopy**
Impurity studies in fusion devices using laser-fluorescence spectroscopy, 6:22902
**Impurities**
Impurity studies in fusion devices using laser-fluorescence spectroscopy, 6:22902
**Interferometers**
Eight-chord $CO_2$ interferometer for plasma-density measurements on ZT-40, 6:22880 (LA-UR—81-1148)
**Laser Radiation**
Eight-chord $CO_2$ interferometer for plasma-density measurements on ZT-40, 6:22880 (LA-UR—81-1148)
Optical diagnostics of $CO_2$ laser-fusion targets using backscattered light, 6:22881 (LA-UR—81-1435)
**Laser Spectroscopy**
Impurity studies in fusion devices using laser-fluorescence spectroscopy, 6:22902
**Photodetectors**
High-speed photodetector for plasma diagnostics, 6:22879 (LA-UR—81-1028)
**PLASMA DRIFT**
**Parametric Instabilities**
Toroidal drift modes driven by ion pressure gradients, 6:22892
**PLASMA HEATING**
*See also HIGH-FREQUENCY HEATING*
*LASER-RADIATION HEATING*
**Drift Instability**
Irreversibility and transport in the lower hybrid drift instability, 6:22895
**PLASMA SHEET**
**Drift Instability**
Current-driven microinstabilities in a neutral sheet, 6:22891
**PLASMA WAVES**
**Landau Damping**
Toroidal effects on propagation, damping, and linear mode conversion of lower hybrid waves, 6:22894
**Wave Propagation**
Electromagnetic waves in a half-space plasma, 6:22864 (ORNL-tr—4750)
**PLASTICS**
*See also ORGANIC POLYMERS*
*POLYACRYLATES*
*POLYETHYLENES*
*TEFLON*
**Histological Techniques**
Plastic-embedded human marrow biopsy specimens, 6:22646
**PLATINUM**
**Atom Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Molecule Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Oxidation**
Recent advances in Pt coating of microspheres by a batch magnetron sputtering process, 6:22938
**PLATINUM ALLOYS**
**Electronic Structure**
Surface segregation and surface electronic structure of PtCu alloys: Dependence on atomic coordination, 6:22288
**Photoelectron Spectroscopy**
Surface segregation and surface electronic structure of PtCu alloys: Dependence on atomic coordination, 6:22288
**PLATINUM COMPOUNDS**
**Mutagenesis**
Quantitative mammalian cell mutagenesis and a preliminary study of the mutagenic potential of metallic compounds, 6:22715
**PLT DEVICES**
*(Princeton Large Torus.)*
**High-Frequency Heating**
Computer simulation of lower-hybrid heating in tokamaks. Final report, 6:22877 (DOE/ER/53106—T1)
**Neutral Atom Beam Injection**
Toroidal plasma rotation in the PLT tokamak with neutral-beam injection, 6:22886 (PPPL—1792)
**PLUTONIUM**
**Chelating Agents**
Specific sequestering agents for the actinides, 6:22698
**Ion Exchange Chromatography**
Automated ion-exchange system for the rapid separation of plutonium from impurities in safeguards analyses, 6:22359
**Mass Spectroscopy**
Analysis of plutonium and uranium by the resin bead-mass spectrometric method, 6:22358
**Nondestructive Analysis**
Gamma ray NDA assay system for total plutonium and isotopics in plutonium product solutions, 6:21712
**Quantitative Chemical Analysis**
Computer-assisted controlled-potential coulometric determination of plutonium for safeguards measurements, 6:22353
**Radioecological Concentration**
Deposition and retention of plutonium in the United States general population, 6:22556 (LA-UR—81-1175)
**Tissue Distribution**
Deposition and retention of plutonium in the United States general population, 6:22556 (LA-UR—81-1175)
**Voltametry**
Computer-assisted controlled-potential coulometric determination of plutonium for safeguards measurements, 6:22353
**X-Ray Fluorescence Analysis**
Nondestructive, energy-dispersive, x-ray fluorescence analysis of product stream concentrations from reprocessed nuclear fuels, 6:21647
**X-Ray Spectra**
Evaluation of an l/sub III/ x-ray absorption-edge densitometer for assay of mixed uranium-plutonium solutions, 6:22517
**PLUTONIUM 238**
**Calorimetry**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**Gamma Spectroscopy**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**PLUTONIUM 239**
**Calorimetry**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**Electron Spin Resonance**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)
**Gamma Spectroscopy**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**PLUTONIUM 240**
**Calorimetry**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**Gamma Spectroscopy**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**PLUTONIUM 241**
**Calorimetry**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**Gamma Spectroscopy**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**PLUTONIUM 242**
**Calorimetry**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)

**PLUTONIUM DIOXIDE**
**Isotope Ratio**
Determination of plutonium isotopic composition by gamma-ray spectroscopy, 6:22330 (LA-UR—1461)
**Materials Testing**
Environmental and radiological safety studies. Interaction of $^{238}PuO_2$ heat sources with terrestrial and aquatic environments. Progress report, October 1-December 31, 1980, 6:21691 (LA—8811-PR)
**Physical Radiation Effects**
Irradiated mixed-oxide-fuel and fission-gas-release behavior during ex-reactor thermal-transient tests, 6:22036 (HEDL-SA—2175)
**Production**
Materials measurement and accounting in an operating plutonium conversion and purification process. Phase I. Process modeling and simulation, 6:21694 (LA—8809-MS)
**PLUTONIUM ISOTOPES**
**Gamma Spectroscopy**
Study of a two-detector method for measuring plutonium isotopics, 6:21711
**Isotope Ratio**
Study of a two-detector method for measuring plutonium isotopics, 6:21711
**Nondestructive Analysis**
Gamma ray NDA assay system for total plutonium and isotopics in plutonium product solutions, 6:21712
**PLUTONIUM OXIDES**
**Thermodynamic Properties**
Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species, 6:22410
Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species, 6:21645
**PNA**
*See POLYCYCLIC AROMATIC HYDROCARBONS*
**POLAND**
**Coordinated Research Programs**
Coal gettability testing: the evaluation methods and coal gettability checking in strata, 6:21555 (DOE/TIC—1015202)
**POLARIZED TARGETS**
**Fabrication**
Studies on a high-grade polarized lithium-6 target, 6:22506 (ANL-Trans—1195)
**POLLUTION CONTROL EQUIPMENT**
**Cost Benefit Analysis**
Air quality analysis of Phase I of the proposed oil backout legislation (Lead abstract), 6:21540 (ANL/EES-TM—130)
**POLLUTION REGULATIONS**
**Compliance**
Assessment of the proposed legislation, 6:22553 (ANL/EES-TM—130)
Regional and national $SO_2$ control costs, 6:22464 (ANL/EES-TM—130)
**Implementation**
In pursuit of clean air: a data book of problems and strategies at the state level. Supplement, 6:22535 (ANL/EES-TM—129)
**POLONIUM 210**
**Environmental Transport**
Preliminary study of the transport and distribution of radium, radon and their alpha-emitting daughters using nuclear emulsions and polonium-210. Final report, 6:21640 (GJBX—144(81))
**POLYACRYLATES**
**Surface Finishing**
Polymeric mandrels: supersmooth finish by an infusion process, 6:22309
**POLYATOMIC MOLECULES**
**Energy Levels**
Method for nuclear spin statistics in molecular spectroscopy, 6:22796
**POLYCYCLIC AROMATIC HYDROCARBONS**
**Biological Effects**
Use of lymphoblastoid cells for the estimation of environmental insults to DNA. Comprehensive report of the overall activities of the contract during the past three years. Progress report, August 1, 1978-June 31, 1981, 6:22704 (DOE/EV/02040—T1)
**Environmental Transport**
Critical pathways of polycyclic aromatic hydrocarbons in aquatic environments, 6:22584
**Laser Spectroscopy**
Laser-excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 6:22345
**Separation Processes**
Bio/organic analysis section, 6:22334 (ORNL—5738)
**Toxicity**
Chemical carcinogenesis. Chapter 12, 6:22717
**POLYETHYLENES**
**Combustion Properties**
Modelling of burning and extinction characteristics of a polymer diffusion flame and comparison with experiment, 6:22416 (LBL—12214)
**Comparative Evaluations**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**POLYMERASES**
**Biochemical Reaction Kinetics**
HeLa cell DNA polymerase $\alpha$ is tightly associated with tryptophanyl-tRNA synthetase and diadenosine 5',5'''-$P^1$,$P^4$-tetraphosphate binding activities, 6:22614
**POLYMERS**
*See also ORGANIC POLYMERS*
*PLASTICS*
Polymer shells by the droplet method, 6:22942
**Chemical Vapor Deposition**
In situ seeding of high Z elements with glow discharge polymerized organic coatings, 6:22944
**Flammability**
Modelling of burning and extinction characteristics of a polymer diffusion flame and comparison with experiment, 6:22416 (LBL—12214)
**Microradiography**
Microradiographic characterization of metal and polymer coated microspheres, 6:22946
**Molecular Models**
Application of dimensional regularization to single chain polymer static properties: Conformational space renormalization of polymers. III, 6:22804
**POLYNUCLEAR HYDROCARBONS**
*See CONDENSED AROMATICS*
**POLYPEPTIDES**
**Biosynthesis**
Adenovirus type 2 expresses fiber in monkey-human hybrids and reconstructed cells, 6:22653
**POLYSACCHARIDES**
*See also DEXTRAN*
*GLYCOGEN*
**Copolymerization**
Model acrylamide random and graft copolymers for utilization in enhanced oil recovery, 6:22310
**POLYTETRAFLUORETHYLENE**
*See TEFLON*
**POPULATION DYNAMICS**
**Biological Models**
Implications of a partial-differential-equation cohort model, 6:22610
Natural variability as a source of error in model predictions, 6:22612
**Information**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
**POROUS MATERIALS**
**Permeability**
Linear oil displacement by the emulsion entrapment process, 6:21577
**PORPHYRA**
**Absorption Spectra**
Phycobilisome-thylakoid topography on photosynthetically active vesicles of Porphyridium cruentum, 6:22661

**PORPHYRINS**
*See also CHLOROPHYLL*
*HEME*
**Photochemical Reactions**
Electron transfer reactions in cofacial diporphyrins, 6:22626
**Raman Spectra**
Simple interpretation of Raman excitation spectra of metalloporphyrins, 6:22338
**POSITIVE IONS**
*See CATIONS*
**POTABLE WATER**
*See DRINKING WATER*
**POTASSIUM**
**Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Emission Spectroscopy**
Laser-induced breakdown spectroscopy: detecting sodium and potassium in coal gasifiers, 6:22329 (LA-UR—81-1526)
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Laser Spectroscopy**
Laser-induced breakdown spectroscopy: detecting sodium and potassium in coal gasifiers, 6:22329 (LA-UR—81-1526)
**Membrane Transport**
Lymphocyte sodium concentration regulates monovalent cation transport after PHA stimulation, 6:22643
**Removal**
Recovery of aluminum from coal fly-ash by HCl sparge crystallization, 6:21539 (ORNL/MIT—327)
**POTASSIUM COMPOUNDS**
**Membrane Transport**
Action of protein synthesis inhibitors in blocking electrogenic $H^+$ efflux from corn roots, 6:22663
**POTASSIUM HYDRIDES**
**Interatomic Forces**
Molecular potentials and relaxation dynamics, 6:22790 (UCRL—85577)
Molecular potentials and relaxation dynamics, 6:22791 (UCRL—85577(Rev.1))
**POTENTIAL SCATTERING**
**Optical Models**
Doorway state approach to optical potential scattering, 6:22855
**POTHEADS**
**Design**
Evaluation, design, development and delivery of a 1200-kV prototype termination. Ninth technical progress report, December 1, 1980-February 28, 1981, 6:22012 (DOE/ET/29068—T5)
**Performance Testing**
Evaluation, design, development and delivery of a 1200-kV prototype termination. Ninth technical progress report, December 1, 1980-February 28, 1981, 6:22012 (DOE/ET/29068—T5)
**POWER GENERATION**
*See also COGENERATION*
**Budgets**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Financial Data**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Fossil Fuels**
Advanced Power Systems Division (Report section), 6:22136 (EPRI-P—1726-SR)
**Research Programs**
1981-1985 research and development program plan: program descriptions, 6:22134 (EPRI-P—1726-SR)
Advanced Power Systems Division (Report section), 6:22136 (EPRI-P—1726-SR)
**POWER POOLS**
*See INTERCONNECTED POWER SYSTEMS*
**POWER REACTORS**
*See also ARKANSAS-2 REACTOR*
*BEAVER VALLEY-1 REACTOR*
*CLINCH RIVER BREEDER REACTOR*
*EBR-2 REACTOR*
*PROCESS HEAT REACTORS*
*ROWE YANKEE REACTOR*
*SHIPPINGPORT REACTOR*
*SURRY-1 REACTOR*
*THREE MILE ISLAND-2 REACTOR*
*TURKEY POINT-3 REACTOR*
*WNP-1 REACTOR*
**Comparative Evaluations**
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**Site Selection**
Learning function in nuclear reactor operation and its implications for siting policy, 6:22081 (ORAU/IEA—81-4(M))
**Specifications**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Tables**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**POWER SYSTEMS**
*See also AC SYSTEMS*
*DC SYSTEMS*
*INTERCONNECTED POWER SYSTEMS*
**Frequency Control**
Coordination of economic dispatch and load-frequency control in electric power systems, 6:22018
**Load Analysis**
Coordination of economic dispatch and load-frequency control in electric power systems, 6:22018
Economic dispatch with generation constraints, 6:22021
Statistical synthesis of power system functional load models, 6:22019
**Magnetic Energy Storage**
Superconducting magnetic energy storage applications and benefits for electric utility power systems, 6:22086
**Outages**
Analysis of bulk-power-system failures and review of utility security and restoration procedures, 6:22011 (DOE/EP—0005)
**Reliability**
Analysis of bulk-power-system failures and review of utility security and restoration procedures, 6:22011 (DOE/EP—0005)
**Research Programs**
1981-1985 research and development program plan: program descriptions, 6:22134 (EPRI-P—1726-SR)
Advanced Power Systems Division (Report section), 6:22136 (EPRI-P—1726-SR)
Electrical Systems Division (Report section), 6:22135 (EPRI-P—1726-SR)
**POWER TRANSMISSION LINES**
**Corona Discharges**
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:22015
**Electric Fields**
Investigation of corona and field effects of ac/dc hybrid transmission lines, 6:22015
**POWER TRANSMISSION TOWERS**
**Foundations**
Impedance characteristics of large tower footings to a 100/mu/s wide square wave of current, 6:22016
**PRASEODYMIUM**
**Solvent Extraction**
Mixed ligand chelate extraction of lanthanides with 5,7-dibromo-8-quinolinol systems, 6:22344
**PRASEODYMIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**PREAMPLIFIERS**
**Electronic Circuits**
Charge sensitive preamplifier (12 Mar 1981) (Engineering Materials), 6:22509 (CAPE—2690)

**PRESSURE GAGES**
**Performance**
Commentary on differential-pressure measurements at high reference pressures, 6:22442 (EGG—1183-1800)
**PRESSURE VESSELS**
**Standards**
Class 1 nuclear components (supplement to ASME Boiler and Pressure Vessel Code, Section III, Subsections NCA and NB), 6:22045 (NE-E—15-2NB-T(Rev.)(1-81))
**Welding**
Development of automated welding process for field fabrication of thick walled pressure vessels. Second quarterly report, FY 1981, 6:22051 (DOE/OR/13511—T1)
**PRESSURIZED WATER REACTORS**
*See PWR TYPE REACTORS*
**PRIMARY COOLANT CIRCUITS**
**Restraints**
Experimental benchmark for piping system dynamic-response analyses, 6:22032 (CONF-810625—13)
**PRINCETON LARGE TORUS**
*See PLT DEVICES*
**PROCESS DEVELOPMENT UNITS**
Low cost solar array project. Quarterly progress report, January-March, 1981, 6:21765 (DOE/JPL/954334—18)
**Design**
Development of a polysilicon process based on chemical vapor deposition (Phase 1). Fifth quarterly progress report, 1 October-31 December 1980, 6:21769 (DOE/JPL/955533—81/5)
**Safety Engineering**
Safety analysis of the 1000 lb/day coal-liquefaction PDU, 6:21505 (DOE/PC/30198—T5)
**PROCESS HEAT**
*See also GEOTHERMAL PROCESS HEAT*
*SOLAR PROCESS HEAT*
**Data Acquisition Systems**
Status report on the project for a standardized data acquisition system, 6:21877 (UCID—18893)
**PROCESS HEAT REACTORS**
**Design**
Pebble Bed Reactor Plant screening evaluation. Volume 1. Overall plant and reactor system (300 MW(t) Multiplex plant), 6:22047 (DOE/ET/35202—T1(Vol.1))
**Energy Transport**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)
**Thermal Energy Storage Equipment**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)
**PROCESS SOLUTIONS**
**Qualitative Chemical Analysis**
Evaluation of an l/sub III/ x-ray absorption-edge densitometer for assay of mixed uranium-plutonium solutions, 6:22517
**PROCESSING (ORES)**
*See ORE PROCESSING*
**PRODUCTION (HYDROGEN)**
*See HYDROGEN PRODUCTION*
**PRODUCTION REACTORS**
*(For the production of fissile materials only; see also IRRADIATION REACTORS.)*
**Specifications**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Tables**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**PROGRAMMING LANGUAGES**
**Comparative Evaluations**
Comparison of programming languages: Ada, Praxis, Pascal, C (Ada, Praxis, Pascal, and C), 6:22980 (UCRL—15346)
**PROJECTILES**
**Impact Shock**
Energy flow in high speed perforation and cutting, 6:22432 (UCRL—85016)
**Kinetic Energy**
Energy flow in high speed perforation and cutting, 6:22432 (UCRL—85016)
**PROMETHAZINE**
*See AMINES*
*PHENOTHIAZINES*
**PROPANE**
**Combustion**
Experimental and theoretical study of flame inhibition by bromine-containing compounds, 6:21731 (UCRL—85409)
**PROPORTIONAL COUNTERS**
**Accuracy**
Examination of LWR irradiated fuel assemblies using simple ion chamber techniques, 6:22056
**PROTECTION (RADIATION)**
*See RADIATION PROTECTION*
**PROTEIN DENATURATION**
**Qualitative Chemical Analysis**
Method for studying proteins in 2-D gels using thermal denaturation analysis, 6:22621
**PROTEINS**
**Biosynthesis**
Action of protein synthesis inhibitors in blocking electrogenic $H^+$ efflux from corn roots, 6:22663
**Electrophoresis**
Method for studying proteins in 2-D gels using thermal denaturation analysis, 6:22621
Two-dimensional electrophoresis of human urinary proteins in health and disease, 6:22624
**PROTON REACTIONS**
**Inelastic Scattering**
Mechanisms for (p,p') reactions in the continuum, 6:22846
**Particle Production**
Polarization of $S^+$ hyperons produced by 400-GeV protons, 6:22821
**PROTON-ANTIPROTON INTERACTIONS**
**Particle Production**
Highlights of high energy pp, anti pp and $e^+e^-$ interactions, 6:22817 (BNL—29465)
**PROTON-PROTON INTERACTIONS**
**Particle Production**
Highlights of high energy pp, anti pp and $e^+e^-$ interactions, 6:22817 (BNL—29465)
**PROTONS**
**Structure Functions**
Internal spin structure of the proton from high energy polarized e-p scattering, 6:22825 (SLAC-PUB—2674)
**PTFE**
*See TEFLON*
**PUBLIC BUILDINGS**
**Design**
Design of a super-insulated energy education center, 6:21912
**Energy Conservation**
Design of a super-insulated energy education center, 6:21912
**Energy Management**
Energy management handbook for state facilities, 6:22220
**Solar Space Heating**
Design of a super-insulated energy education center, 6:21912
Solar energy system economic evaluation. Final report for SEECO Lincoln, Lincoln, Nebraska, 6:21854 (DOE/NASA/CR—161724)
**Trombe Walls**
Bridgeview Park facility solar retrofit, 6:21858 (DOE/R5/10216—T1)
**Weatherization**
Bridgeview Park facility solar retrofit, 6:21858 (DOE/R5/10216—T1)
**PUBLIC UTILITIES**
*See also ELECTRIC UTILITIES*
**Photovoltaic Power Plants**
Photovoltaics Program: utility interface southwest regional workshop proceedings, 6:21820 (DOE/ET/20356—2)
**PUERTO RICO**
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)

**PULSE GENERATORS**
**Cost**
Pulsed power for electromagnetic launching, 6:22426 (SAND—80-1987)
**Design**
Pulsed power for electromagnetic launching, 6:22426 (SAND—80-1987)
**PUMPS**
*See also VACUUM PUMPS*
*WATER PUMPS*
**Design**
Magnetic drive vane pump (Mound drawing No. 18889 and 18890) (12 Mar 1981) (Engineering Materials), 6:22433 (CAPE—2689)
**PVC**
*(Polyvinyl chloride.)*
**Comparative Evaluations**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**Performance Testing**
Klegecell: a new lightweight insulating material with superior properties, 6:21906
**Physical Properties**
Klegecell: a new lightweight insulating material with superior properties, 6:21906
**PWR TYPE REACTORS**
*See also ARKANSAS-2 REACTOR*
*BEAVER VALLEY-1 REACTOR*
*ROWE YANKEE REACTOR*
*SHIPPINGPORT REACTOR*
*SURRY-1 REACTOR*
*THREE MILE ISLAND-2 REACTOR*
*TURKEY POINT-3 REACTOR*
*WNP-1 REACTOR*
**Containment Systems**
Evaluation of the nucledyne passive containment system, 6:22025 (ALO—137)
Some hydrogen-control considerations for ice-condenser nuclear plants, 6:22082 (UCRL—15345)
**Fuel Assemblies**
New developments in nondestructive measurement and verification of irradiated lwr fuels, 6:21716
**Loss of Coolant**
Evaluation of ECC bypass data with a nonlinear constrained MLE technique, 6:22067 (CONF-791016—)
Heat transfer in vertical countercurrent steam-water flooding flows, 6:22084
Some factors affecting the metering of subcooled water with a choked venturi, 6:22071 (CONF-810406—4)
**Reactor Protection Systems**
Some hydrogen-control considerations for ice-condenser nuclear plants, 6:22082 (UCRL—15345)
**Reactor Safety**
Learning function in nuclear reactor operation and its implications for siting policy, 6:22081 (ORAU/IEA—81-4(M))
**PYRAZINES**
*See also PIPERAZINES*
**Electronic Structure**
Electronic structural properties and photosynthesis, 6:21810
**Photolysis**
Laser-flash-induced dissociation and recombination of aqueous pentacyano (2-methylpyrazine)ferrate(II) ion, 6:22396
**Recombination**
Laser-flash-induced dissociation and recombination of aqueous pentacyano (2-methylpyrazine)ferrate(II) ion, 6:22396
**Structural Chemical Analysis**
Electronic structural properties and photosynthesis, 6:21810
**PYRIDINE**
**Oxidation**
Fundamentals of nitric oxide formation in fossil fuel combustion. Progress report, 29 June-28 September 1980, 6:22414 (DOE/ET/10593—T1)
**PYRIDINES**
*See also ACRIDINES*
**Absorption Spectroscopy**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Adsorption**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Chromatography**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**PYRIMIDINES**
*See also CYTOSINE*
*THYMIDINE*
*URACILS*
**Quantitative Chemical Analysis**
Measurement of pyrimidine dimers in spheroplasts of Bacillus subtilis, 6:22701
**PYRITE**
**Catalytic Effects**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)
**Scanning Electron Microscopy**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
**X-Ray Spectroscopy**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
**PYROLYTIC CARBON**
**Chemical Vapor Deposition**
Chemically vapor deposited coatings for multibarrier containment of nuclear wastes, 6:21661 (CONF-8005107—)
**PYRRHOTITE**
**Catalytic Effects**
Role of non-ferrous coal minerals and by-product metallic wastes in coal liquefaction. Technical progress report, September 1-November 30, 1979, 6:21499 (DOE/ET/14806—T2)
**Scanning Electron Microscopy**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
**X-Ray Spectroscopy**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
**PYRROLES**
**Absorption Spectroscopy**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Adsorption**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Chromatography**
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Electronic Structure**
Electronic structural properties and photosynthesis, 6:21810
**Structural Chemical Analysis**
Electronic structural properties and photosynthesis, 6:21810

## Q

**QUANTUM CHROMODYNAMICS**
High-temperature Yang-Mills theories and three-dimensional quantum chromodynamics, 6:22828
**Coupling Constants**
Coupling-constant analyticity and the renormalization group, 6:22838
**Green Function**
Coupling-constant analyticity and the renormalization group, 6:22838
**Infrared Divergences**
How super-renormalizable interactions cure their infrared divergences, 6:22827

**QUANTUM ELECTRODYNAMICS**
**Gauge Invariance**
Fermionic expansion in quantum electrodynamics, 6:22837
**Series Expansion**
Fermionic expansion in quantum electrodynamics, 6:22837
**QUARK CONFINEMENT**
*See BAG MODEL*
**QUARTZ**
**Physical Radiation Effects**
Radiation-induced conductivity and high-temperature Q changes in quartz resonators, 6:22518 (SAND—81-0126C)
**Purification**
Radiation-induced conductivity and high-temperature Q changes in quartz resonators, 6:22518 (SAND—81-0126C)
**QUATERNARY COMPOUNDS**
**Chemical Reactions**
Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis, 6:22408
**Radiolysis**
Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis, 6:22408
**QUINOLINES**
**Denitrification**
Development of unique catalysts for hydrodenitrogenation of coal-derived liquids. Annual report, September 15, 1979-September 15, 1980, 6:21494 (DOE/ET/11429—T1)
**Liquid Column Chromatography**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**Mass Spectroscopy**
Ribbon storage techniques for liquid chromatography: mass spectrometry, 6:22341
**QUINONES**
**Photochemistry**
Redox titration of electron acceptor Q and the plastoquinone pool in Photosystem II, 6:22629
**Radiolysis**
Resonance Raman scattering of semiquinone radical anions, 6:22798
**Raman Spectra**
Resonance Raman scattering of semiquinone radical anions, 6:22798

## R

**RADIAL FLOW MHD GENERATORS**
*See DISK MHD GENERATORS*
**RADIATION ABSORPTION ANALYSIS**
Multi-energy gamma-ray automated scanning system, 6:22328 (LA-UR—81-1511)
**RADIATION ACCIDENTS**
**Alarm Systems**
Nuclear criticality experiments and safety, 6:22079 (LA—8797-PR)
**Radiation Monitors**
Nuclear criticality experiments and safety, 6:22079 (LA—8797-PR)
**RADIATION DETECTORS**
*See also HODOSCOPES*
*IONIZATION CHAMBERS*
*PROPORTIONAL COUNTERS*
*RADIATION MONITORS*
*RADIOMETERS*
*SHOWER COUNTERS*
**Research Programs**
Environmental Measurements Laboratory annual report, calendar year 1980, 6:22672 (DOE/EML—392)
**RADIATION DOSEMETERS**
*See DOSEMETERS*
**RADIATION DOSIMETRY**
*See DOSIMETRY*
**RADIATION HYGIENE**
*See RADIATION PROTECTION*
**RADIATION MONITORS**
**Research Programs**
Nuclear criticality experiments and safety, 6:22079 (LA—8797-PR)
**RADIATION PROTECTION**
**Standards**
Historical perspectives on limits for internal emitters, 6:22861 (PNL-SA—9333)
**RADIATION SAFETY**
*See RADIATION PROTECTION*
**RADIATION TRANSPORT**
**Algorithms**
High-order accurate numerical algorithm for three-dimensional transport prediction, 6:22987
**RADIATORS**
**Heat Transfer**
Measurements and simulations of radiative cooling through IR transparent windscreens, 6:21888
**RADICALS**
*See also HYDROXYL RADICALS*
*METHYLENE RADICALS*
**Chemical Reactions**
Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis, 6:22408
**Electron Spin Resonance**
ESR study of DNA base cation radicals produced by attack of oxidizing radicals, 6:22405
Studies of the mechanism of coal hydrogenation by electron spin resonance. Quarterly technical progress report No. 4, 1 September 1980-31 November 1980, 6:21503 (DOE/PC/30072—T3)
**RADIOACTIVE BIOLOGICAL WASTES**
*See RADIOACTIVE WASTES*
**RADIOACTIVE MATERIALS**
*See also RADIOACTIVE WASTES*
**Chemical Analysis**
Technical support, 6:22333 (ORNL—5738)
**Radiometric Analysis**
CAMAC gamma ray scanning system, 6:21697 (LA-UR—81-1512)
**RADIOACTIVE WASTE DISPOSAL**
*See also SHAFT EXCAVATIONS*
**Charges**
Discount rate in the spent fuel storage and disposal fee, 6:21649 (ONWI—189)
**Geologic Deposits**
NWTS program criteria for mined geologic disposal of nuclear waste: program objectives, functional requirements, and system performance criteria, 6:21665 (DOE/NWTS—33(1))
Technical progress report for the quarter 1 April-30 June 1980, 6:21675 (ONWI—9(3)(1980))
**High-Level Radioactive Wastes**
Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)
NWTS program criteria for mined geologic disposal of nuclear waste: program objectives, functional requirements, and system performance criteria, 6:21665 (DOE/NWTS—33(1))
**Low-Level Radioactive Wastes**
Low-level-waste-disposal methodologies, 6:21672 (LA-UR—81-1385)
**Marine Disposal**
Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)
**Research Programs**
Technical progress report for the quarter 1 April-30 June 1980, 6:21675 (ONWI—9(3)(1980))
**Retrieval Systems**
Retrievability: technical considerations, 6:21678 (ONWI—203)
**Salt Deposits**
Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis. Final report, 6:21667 (DOE/TIC—1021731)
Technical summary and index for national waste terminal storage repository No. 1 and No. 2 conceptual design reports, special study No. 6, 6:21679 (ONWI—234)

**Site Selection**
Technical progress report for the quarter 1 April-30 June 1980, 6:21675 (ONWI—9(3)(1980))
**Socio-Economic Factors**
Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis, 6:21668 (DOE/TIC—1022080)
Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis. Final report, 6:21667 (DOE/TIC—1021731)
**Specifications**
Low-level-waste-disposal methodologies, 6:21672 (LA-UR—81-1385)
NWTS program criteria for mined geologic disposal of nuclear waste: program objectives, functional requirements, and system performance criteria, 6:21665 (DOE/NWTS—33(1))
**Underground Disposal**
Low-level-waste-disposal methodologies, 6:21672 (LA-UR—81-1385)
Retrievability: technical considerations, 6:21678 (ONWI—203)

**RADIOACTIVE WASTE FACILITIES**
**Construction**
Technical progress report for the quarter 1 April-30 June 1980, 6:21675 (ONWI—9(3)(1980))
**Design**
Technical summary and index for national waste terminal storage repository No. 1 and No. 2 conceptual design reports, special study No. 6, 6:21679 (ONWI—234)
**Hydrology**
Effective summary evaluators for deep nuclear waste repositories: geohydrologic response function., 6:21681 (PNL-SA—9092)
**Licensing**
Technical progress report for the quarter 1 April-30 June 1980, 6:21675 (ONWI—9(3)(1980))
**Radionuclide Migration**
Use of Geohydrologic Response Functions in the assessment of deep nuclear waste repositories: assessment of effectiveness of geologic isolation systems, 6:21692 (PNL—3817)
**Regional Analysis**
Logistics characterization for regional spent fuel repositories concept, 6:21677 (ONWI—124)
**Remote Handling Equipment**
Considerations for development of specifications for subsurface waste-handling equipment, 6:21676 (ONWI—75)
**Safeguards**
Monte Carlo calculational design of an NDA instrument for the assay of waste products from high enriched uranium spent fuels, 6:21690
**Site Selection**
The use of geostatistics in high level radioactive waste repository site characterization, 6:21688
**Socio-Economic Factors**
Proposed waste isolation pilot project (WIPP) and impacts in the state of New Mexico: a socio-economic analysis, 6:21668 (DOE/TIC—1022080)

**RADIOACTIVE WASTE MANAGEMENT**
*See also RADIOACTIVE WASTE STORAGE*
**Spent Fuels**
Monte Carlo calculational design of an NDA instrument for the assay of waste products from high enriched uranium spent fuels, 6:21690

**RADIOACTIVE WASTE PROCESSING**
**Actinides**
Hot and cold pressing of $(La,Ce)PO_4$-based nuclear waste forms, 6:21658 (CONF-8005107—)
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Chemical Vapor Deposition**
Chemically vapor deposited coatings for multibarrier containment of nuclear wastes, 6:21661 (CONF-8005107—)
**Combustion**
Combustion-rate predictions for controlled-air incinerators, 6:21670 (DP-MS—81-8)
Design and operation of a prototype incinerator for beta-gamma waste, 6:21669 (DP-MS—80-123)
**High-Level Radioactive Wastes**
Application of SYNROC to high-level defense wastes, 6:21654 (CONF-8005107—)
Design and performance of atomizing nozzles for spray calcination of high-level wastes, 6:21680 (PNL—3702)
High level waste fixation in cermet form, 6:21663 (CONF-8005107—)
Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D, 6:21687 (UCRL—15347)
**Low-Level Radioactive Wastes**
Design and operation of a prototype incinerator for beta-gamma waste, 6:21669 (DP-MS—80-123)
**Research Programs**
Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D, 6:21687 (UCRL—15347)
**Simulation**
Hot and cold pressing of $(La,Ce)PO_4$-based nuclear waste forms, 6:21658 (CONF-8005107—)
**Solidification**
Alternate nuclear waste forms and interactions in geologic media, 6:21653 (CONF-8005107—)
Application of SYNROC to high-level defense wastes, 6:21654 (CONF-8005107—)
Design and performance of atomizing nozzles for spray calcination of high-level wastes, 6:21680 (PNL—3702)
High level waste fixation in cermet form, 6:21663 (CONF-8005107—)
Review of glass ceramic waste forms, 6:21664 (CONF-8005107—)
Sol-gel technology applied to alternative high-level waste forms development, 6:21660 (CONF-8005107—)
Survey of concrete waste forms, 6:21659 (CONF-8005107—)
**SYNROC Process**
Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D, 6:21687 (UCRL—15347)
**Vitrification**
Component effects in mixture experiments, 6:21652 (CONF-791016—)
Design and installation of a pilot-plant to vitrify ICPP-simulated calcined high-level waste, 6:21671 (ENICO—1087)

**RADIOACTIVE WASTE STORAGE**
**Research Programs**
Nevada nuclear waste storage investigations. Quarterly report, October-December, 1980, 6:21674 (NVO—196-21)
**Underground Storage**
Effective summary evaluators for deep nuclear waste repositories: geohydrologic response function., 6:21681 (PNL-SA—9092)

**RADIOACTIVE WASTES**
*See also CALCINED WASTES*
*HIGH-LEVEL RADIOACTIVE WASTES*
**Counting Techniques**
Uranium and plutonium assay of created waste by gamma ray, singles neutron, and slow neutron coincidence counting, 6:21689
**Electron Microprobe Analysis**
Digitally controlled x-ray mapping, 6:22337 (SAND—81-0331C)
**Leaching**
Influence of waste solid on nuclide dispersal, 6:21662 (CONF-8005107—)
**Nondestructive Analysis**
Monte Carlo calculational design of an NDA instrument for the assay of waste products from high enriched uranium spent fuels, 6:21690
Preparation of prototype NDA reference materials: a progress report, 6:21702
**Radionuclide Migration**
Hydrologic conditions at the Idaho National Engineering Laboratory, Idaho. Emphasis: 1974-1978, 6:22594 (IDO—22060)
**Standards**
Preparation of prototype NDA reference materials: a progress report, 6:21702

**Volatility**
Volatility of some potential high-level radioactive waste forms, 6:21666
**Waste-Rock Interactions**
Influence of waste solid on nuclide dispersal, 6:21662 (CONF-8005107—)
**RADIOBIOLOGICAL EFFECTS**
*See BIOLOGICAL RADIATION EFFECTS*
**RADIOCARBON DATING**
*See CARBON 14*
**RADIOCHEMICAL ANALYSIS**
Nuclear and radiochemical analysis, 6:22335 (ORNL—5738)
**RADIOFREQUENCY SYSTEMS**
*See RF SYSTEMS*
**RADIOISOTOPE HEAT SOURCES**
**Research Programs**
Silicon germanium (SiGe) radioisotope thermoelectric generator (RTG) program for space missions. Nineteenth technical progress report, December 1980-January 1981, 6:22153 (DOE/ET/32043—T7)
**RADIOISOTOPE MIGRATION**
*See RADIONUCLIDE MIGRATION*
**RADIOMETERS**
Actinometric measurement of solar ultraviolet, 6:21742
**RADIOMETRIC ANALYSIS**
CAMAC gamma ray scanning system, 6:21697 (LA-UR—81-1512)
**RADIOMETRIC SURVEYS**
**Calibration Standards**
Dynamic Test Range I: follow-on. Narrative report, 6:21625 (GJBX—110-81)
**Data Analysis**
Principal components analysis as a tool for interpreting NURE aerial radiometric survey data, 6:21642
**RADIONUCLIDE MIGRATION**
*(In environment.)*
**Mathematical Models**
Computational codes for calculating dispersion from accidental releases of pollutants, 6:22543 (DP-MS—80-85)
Environmental studies data base development and data synthesis activities of the US Subseabed Disposal Program, 6:21685 (SAND—80-2096)
**RADIOSURGERY**
*See RADIOTHERAPY*
**RADIOTHERAPY**
**Irradiation Devices**
Operations experience at the Bevalac radiotherapy facility, 6:22491 (LBL—11725)
**RADON 222**
**Environmental Transport**
Preliminary study of the transport and distribution of radium, radon and their alpha-emitting daughters using nuclear emulsions and polonium-210. Final report, 6:21640 (GJBX—144(81))
**RAILGUN ACCELERATORS**
**Design**
Design and fabrication of large- and small-bore railguns, 6:22430 (UCRL—84876(Rev.1))
Results of railgun experiments powered by magnetic flux compression generators, 6:22429 (UCRL—84875(Rev.1))
**Fabrication**
Design and fabrication of large- and small-bore railguns, 6:22430 (UCRL—84876(Rev.1))
**Performance**
Results of railgun experiments powered by magnetic flux compression generators, 6:22429 (UCRL—84875(Rev.1))
**Pulse Generators**
Pulsed power for electromagnetic launching, 6:22426 (SAND—80-1987)
**RAMAN EFFECT**
Novel analytic solutions to general four-wave-mixing problems in a Raman medium, 6:22874
**Analytical Solution**
Stimulated Raman scattering and four-wave mixing: steady-state plane-wave analytic solutions, 6:22776 (LA-UR—81-1228)
**RANKINE CYCLE POWER SYSTEMS**
**Parametric Analysis**
Residual energy applications program systems analysis report, 6:22241 (DOE/ET/12866—3)
**Waste Heat Utilization**
Residual energy applications program systems analysis report, 6:22241 (DOE/ET/12866—3)
**RARE EARTH ALLOYS**
**Sorptive Properties**
Hydrogen and deuterium sorption by selected rare earth intermetallic compounds at pressures up to 1500 atm, 6:22375
**RARE EARTH COMPOUNDS**
**Energy Levels**
Optical properties of actinide and lanthanide ions, 6:22378
**Optical Properties**
Optical properties of actinide and lanthanide ions, 6:22378
**Stimulated Emission**
Lanthanide and actinide lasers, 6:22377
**RARE EARTHS**
*See also CERIUM*
*DYSPROSIUM*
*EUROPIUM*
*LANTHANUM*
*LUTETIUM*
*PRASEODYMIUM*
*SAMARIUM*
*YTTERBIUM*
**Meetings**
Lanthanide and actinide chemistry and spectroscopy, 6:22376
**Membrane Transport**
Separation of alkali, alkaline earth and rare earth cations by liquid membranes containing macrocyclic carriers. Third progress report, September 1, 1980-April 1, 1981, 6:22326 (DOE/ER/05016—3)
**Photoionization**
Multistep laser photoionization of the lanthanides and actinides, 6:22811
**RARE GASES**
*See also ARGON*
*HELIUM*
*NEON*
*XENON*
**Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**RARITA-SCHWINGER THEORY**
**Propagator**
Covariant propagators for massive arbitrary-spin fields, 6:22836
**RDF**
*See REFUSE DERIVED FUELS*
**REACTOR ACCIDENTS**
*See also LOSS OF COOLANT*
**After-Heat Removal**
Sodium natural convection testing in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) facility (LMFBR), 6:22072 (CONF-810553—1)
**Probability**
Some notable probability and statistics problems encountered in risk analysis applications, 6:22070 (CONF-791016—)
**Two-Phase Flow**
Numerical simulation for two-phase jet problem, 6:22080 (LA-UR—81-317)
**REACTOR COMPONENTS**
*See also BREEDING BLANKETS*
*REACTOR COOLING SYSTEMS*
*REACTOR CORES*
**Mechanical Vibrations**
Fluid forces on rods vibrating in finite length annular regions, 6:22053
**REACTOR COOLING SYSTEMS**
*See also PRIMARY COOLANT CIRCUITS*
**Seismic Effects**
Comparison of LMFBR piping response obtained using response spectrum and time history methods, 6:22073 (CONF-810625—15)
**REACTOR CORES**
**Heat Transfer**
Summary of the thermal evaluation of LWBR (LWBR Development Program), 6:22041 (WAPD-TM—1385)

**Hydraulics**
Summary of the hydraulic evaluation of LWBR (LWBR development program), 6:22042 (WAPD-TM—1386)
Summary of the thermal evaluation of LWBR (LWBR Development Program), 6:22041 (WAPD-TM—1385)
**Natural Convection**
Natural convection analyses and verification for LMFBR cores, 6:22030
**REACTOR FUELS**
*See NUCLEAR FUELS*
**REACTOR MAINTENANCE**
Application of pattern recognition techniques to a flying robotic arm, 6:22024
**Environmental Impact Statements**
Final environmental impact statement. Surry Power Station, Unit No. 1 steam generator repair, Virginia Electric and Power Company, 6:22604
**REACTOR MATERIALS**
*(See also specific materials.)*
*See also NUCLEAR FUELS*
Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers, 6:22029
**Research Programs**
Nuclear materials progress reports for 1980, 6:22264 (LBL—12548)
**REACTOR PHYSICS**
**Computer Codes**
BOLD VENTURE COMPUTATION SYSTEM for nuclear reactor core analysis, Version III, 6:22038 (ORNL—5711)
**REACTOR PROTECTION SYSTEMS**
**Feasibility Studies**
Some hydrogen-control considerations for ice-condenser nuclear plants (PWR), 6:22082 (UCRL—15345)
**REACTOR SAFETY**
*(Theoretical and experimental investigations of the behavior of reactor types and designs under various real or hypothetical accidents.)*
**Computer Codes**
Application of software engineering to development of reactor-safety codes, 6:22077 (HEDL-SA—2244-FP)
Application of software to development of reactor-safety codes, 6:22078 (HEDL-SA—2244-S)
**Research Programs**
Fast reactor safety program. Progress report, January-March 1980, 6:22066 (ANL/TMC—80-3)
**REACTOR SITING**
*See SITE SELECTION*
**RECEIVERS (SOLAR)**
*See SOLAR RECEIVERS*
**RECTENNAS**
**Site Selection**
Examination of some hypothetical SPS rectenna sites within the contiguous United States of America. Part I. Precipitation effects on hypothetical SPS sites in the USA. Part II. Point-to-point microwave and service mode communications systems near four hypothetical SPS rectenna sites in the continental United States, 6:21812 (DOE/ER/10160—T4)
**RECYCLING (FUEL)**
*See REPROCESSING*
**REFLECTIVE COATINGS**
**Damage**
Laser damage testing of coated reflectors at excimer laser wavelengths, 6:22436 (LA-UR—81-1567)
**REFRACTORIES**
**Corrosion**
AR and TD fossil-energy-materials program. Quarterly progress report, October-December 1980, 6:21513 (ORNL/FMP—81/1)
**REFRACTORY METALS**
**Grinding**
New era for ultrasonic impact grinding, 6:22422 (LA-UR—81-1316)
**REFRIGERATORS**
*See also MAGNETIC REFRIGERATORS*
**Thermal Insulation**
Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)
**REFUSE**
*See SOLID WASTES*
**REFUSE DERIVED FUELS**
*See also MUNICIPAL WASTES*
*SOLID WASTES*
*SYNTHETIC FUELS*
**Data Compilation**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Surveys**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Waste Processing Plants**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**REFUSE-FUELED POWER PLANTS**
**Data Compilation**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Surveys**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**REGION I**
*See NORTH ATLANTIC REGION*
**REGION II**
*See MID-ATLANTIC REGION*
**REGION X**
*See PACIFIC NORTHWEST REGION*
**REGRESSION ANALYSIS**
**Computer Codes**
User's guide to ANYOLS: a flexible stepwise regression program, 6:22973 (EGG-EA—5455)
**REGULATIONS**
*See also POLLUTION REGULATIONS*
**Compliance**
Effects of regulation on the electric utility industry, 6:22602 (EMD—81-35)
**Economic Impact**
Effects of regulation on the electric utility industry, 6:22602 (EMD—81-35)
**REGULATORS (VOLTAGE)**
*See VOLTAGE REGULATORS*
**RELATIVITY THEORY**
**Dirac Equation**
Form of relativistic dynamics with world lines, 6:22869
**Particle Interactions**
Form of relativistic dynamics with world lines, 6:22869
**Poincare Groups**
Form of relativistic dynamics with world lines, 6:22869
**REMOTE HANDLING EQUIPMENT**
Application of pattern recognition techniques to a flying robotic arm, 6:22024
**Design**
Torus sector handling system, 6:22485 (LA-UR—81-1324)
**Operation**
Torus sector handling system, 6:22485 (LA-UR—81-1324)
**RENEWABLE ENERGY SOURCES**
*See also GEOTHERMAL ENERGY*
*HYDROELECTRIC POWER*
*SOLAR ENERGY*
*WAVE POWER*
*WIND POWER*
**Environmental Impacts**
Environmental aspects of renewable energy sources (Review), 6:22141
**Research Programs**
Current energy research and development in Washington State, 1980, 6:22107 (WAOENG—80-17)
Hawaii Natural Energy Institute annual report, 1980, 6:22108
**Reviews**
Annual review of energy. Volume 5 (Book), 6:22122
**REPAIR PATHWAYS**
*See BIOLOGICAL PATHWAYS*
**REPROCESSING**
**Chemical Analysis**
Technical support, 6:22333 (ORNL—5738)

**RESEARCH AND TEST REACTORS**
**Specifications**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Tables**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**RESEARCH PROGRAMS**
**Program Management**
Office of the Inspector General. Annual report, 6:22967 (DOE/IG—0008/1)
**RESIDENTIAL BUILDINGS**
*See also APARTMENT BUILDINGS*
*HOUSES*
**Air Infiltration**
Building infiltration, 6:22176 (CONF-8003114—)
**Energy Consumption**
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: single-family dwellings, 6:22196 (DOE/TIC—11455)
Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings, 6:22222 (DOE/TIC—11459)
**Energy Efficiency**
Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings, 6:22222 (DOE/TIC—11459)
**Energy Efficiency Standards**
High rise buildings, 6:22211 (P—400-80-036)
Phase-two report for the development of Energy-Performance Standards for new buildings. Task report: single-family dwellings, 6:22196 (DOE/TIC—11455)
Phase-two report for the development of Energy-Performance Standards for new buildings. Final report, 6:22198 (DOE/TIC—11457)
Phase two report for the development of energy performance standards for new buildings. Task report: commercial and multi-family residential buildings, 6:22222 (DOE/TIC—11459)
**Energy Losses**
Building infiltration, 6:22176 (CONF-8003114—)
**Photovoltaic Power Supplies**
Residential photovoltaic system designs, 6:21814 (DOE/ET/20279—123)
Residential photovoltaic power systems for the northeast, 6:21816 (DOE/ET/20279—132)
**Solar Space Heating**
Eliminating peak load auxiliary energy use in passive solar residences during winter, 6:21924
Performance of the solarium-assisted dormitory at the White Mountain School, Littleton, NH, 6:21918
Solar Energy System Economic Evaluation final report for IBM System 4, Clinton, Mississippi, 6:21856 (DOE/NASA/CR—161726)
**Solar Water Heating**
Solar Energy System Economic Evaluation final report for IBM System 4, Clinton, Mississippi, 6:21856 (DOE/NASA/CR—161726)
**RESIDENTIAL SECTOR**
**Energy Conservation**
Institutional barriers to energy conservation in Mitchell-Lama housing, 6:22208 (NYSERDA—80-26)
Progress in residential energy conservation: a multi country perspective, 6:22206 (LBL—11701)
**Energy Consumption**
Estimating residential energy consumption from the national interim energy consumption survey: a progress report, 6:22163 (CONF-791016—)
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))
**Information**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
**Power Demand**
Correcting for truncation bias in the analysis of experiments in time-of-day pricing of electricity, 6:22139
End-use approach to demand forecasting, 6:22017
**Surveys**
Pacific Northwest residential energy survey. Volume 2. Technical appendix, 6:22179 (DOE/BP—13061(Vol.2))
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
Pacific Northwest residential energy survey. Volume 6. Oregon cross-tabulations, 6:22183 (DOE/BP—13061(Vol.6))
Pacific Northwest residential energy survey. Volume 7. Idaho cross-tabulations, 6:22184 (DOE/BP—13061(Vol.7))
Pacific Northwest residential energy survey. Volume 8. Montana cross-tabulations, 6:22185 (DOE/BP—13061(Vol.8))
Pacific Northwest residential energy survey. Volume 9. Climate Zone 1 cross-tabulations, 6:22186 (DOE/BP—13061(Vol.9))
Pacific Northwest residential energy survey. Volume 10. Climate Zone 2 cross-tabulations, 6:22187 (DOE/BP—13061(Vol.10))
Pacific Northwest residential energy survey. Volume 11. Climate Zone 3 cross-tabulations, 6:22188 (DOE/BP—13061(Vol.11))
Pacific Northwest residential energy survey. Volume 12. Climate Zone 4 cross-tabulations, 6:22189 (DOE/BP—13061(Vol.12))
**Thermal Energy Storage Equipment**
Preliminary market analysis for customer side of the meter thermal-energy storage, 6:22193 (DOE/ET/26716—T1)
**Weatherization**
Pacific Northwest residential energy survey. Volume 1. Executive summary, 6:22178 (DOE/BP—13061(Vol.1))
**RESIDUAL OILS**
*See PETROLEUM RESIDUES*
**RESIDUES**
*See also ASHES*
**Chemical Composition**
Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979, 6:21538 (DOE/MC/08004—T8)

**Waste Product Utilization**
Determination of valuable metals in liquefaction-process residues, Report No. 45. Quarterly technical progress report, January 1, 1979-March 31, 1979, 6:21538 (DOE/MC/08004—T8)

**RESIDUES (RADIOACTIVE)**
*See RADIOACTIVE WASTES*

**RESONATORS**
Radiation-induced conductivity and high-temperature Q changes in quartz resonators, 6:22518 (SAND—81-0126C)

**RESOURCE CONSERVATION**
**Legislation**
Air quality analysis of Phase I of the proposed oil backout legislation: Introduction, 6:22229 (ANL/EES-TM—130)

**RESOURCE RECOVERY FACILITIES**
**Data Compilation**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Feasibility Studies**
Regional resource recovery feasibility study for Western Piedmont and Centralina Council of Governments, 6:22254 (NCEI—0024)
**Surveys**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)

**RESPIRATORY SYSTEM**
*See also LUNGS*
**Sensitivity**
Studies of pollutant aerosol simulants in normal and susceptible human subjects, 6:22716

**RESPIRATORY TRACT CELLS**
**Hybridization**
Dependence of herpes simplex virus type 1-induced cell fusion on cell type, 6:22650

**RETAIL PRICES**
**Monitoring**
Distillate price-monitoring system. Final report (Kerosene No. 1 and No. 2 home heating oil), 6:21583 (DOE/EIA/06278—T1)
Program to monitor the weekly retail price of home-heating fuel oil No. 2 in the State of New Jersey. Year one final report, 6:21585 (DOE/EIA/10169—T1)

**RETINA**
**Biological Radiation Effects**
Ocular lesions in irradiated beagles, 6:22690 (FDA—81-8042)

**RETORTED SHALES**
*See SPENT SHALES*

**RETORTING**
**Waste Water**
Wastewater treatment in the oil-shale industry, 6:21615 (LBL—11214)

**RETORTS**
*See also CHEMICAL REACTORS*
**Abandoned Sites**
Retort abandonment: issues and research needs, 6:21617 (LBL—11197)
**Decommissioning**
Retort abandonment: issues and research needs, 6:21617 (LBL—11197)
**Environmental Impacts**
Retort abandonment: issues and research needs, 6:21617 (LBL—11197)
**Hydraulics**
Thermomechanics, 6:22037 (LA—8797-PR)
**Stability**
Thermomechanics, 6:22037 (LA—8797-PR)

**RETRIEVAL SYSTEMS**
**Technology Assessment**
Retrievability: technical considerations, 6:21678 (ONWI—203)

**REVERSE-FIELD PINCH**
**Research Programs**
CTR plasma engineering studies. Annual progress report, 1 October 1980-30 September 1981, 6:22878 (DOE/ET/52040—T2)

**RF SYSTEMS**
**Klystrons**
Pulse to pulse klystron diagnosis system, 6:22502 (SLAC-PUB—2702)
**Monitoring**
Pulse to pulse klystron diagnosis system, 6:22502 (SLAC-PUB—2702)

**RHENIUM OXIDES**
**Electronic Structure**
Pressure-induced change in the Fermi surface and electronic structure of metals, 6:22279 (SAND—81-0558C)
**Fermi Level**
Pressure-induced change in the Fermi surface and electronic structure of metals, 6:22279 (SAND—81-0558C)

**RHODE ISLAND**
**Geology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Hydrology**
Northeast Regional Environmental Impact Study: description of the existing Northeast Regional Geohydrology. A supplement to the waste disposal technical report, 6:22723 (DOE/RG—0059)
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)

**RHODIUM COMPLEXES**
**Structural Chemical Analysis**
Alkyl-metal and aryl-metal bond chemistry in coordinately unsaturated polynuclear metal complexes, 6:22371

**RHODIUM COMPOUNDS**
**Luminescence**
Temperature dependence of the luminescence lifetimes of halopentaammine- and hexaamminerhodium(III) compounds in the solid state, 6:22384

**RHODIUM SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581

**RICHLAND FFTF REACTOR**
*See FFTF REACTOR*

**RIEMANN WAVES**
*See SHOCK WAVES*

**RISER CRACKING**
*See COAL LIQUEFACTION*

**RISK ASSESSMENT**
Statistics and risk analysis: getting the acts together, 6:22069 (CONF-791016—)
**Biological Models**
Role of biotransformation in environmental hazard assessment, 6:22585

**RIVERS**
**Biogeochemistry**
Chemical indicators of organic river sources in rivers and estuaries, 6:22563 (CONF-8009140—)
**Geochemistry**
Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries, 6:22562 (CONF-8009140—)

**RIVETS**
*See FASTENERS*

**ROADS**
**Environmental Effects**
Highway right-of-way: mowing versus succession as related to duck nesting, 6:22721

**ROCK MECHANICS**
**J Codes**
JPLAXD: a finite-element program for static plane and axisymmetric analysis of structures in jointed rocks, 6:22732 (UCID—19047)

**ROCKETS**
**Monitoring**
Description of the barium cloud vectoring systems developed for the PLACES test series, 6:22745 (SAND—81-0483)

**ROCKS**
*See also CAP ROCK*
*SYNTHETIC ROCKS*
**Coatings**
Desert varnish: potential for age dating via uranium-series isotopes, 6:22727

**Fluid Flow**
New approaches to problems of fluid flow in fractured-rock masses, 6:22730 (LBL—12511)
**Shear Properties**
JPLAXD: a finite-element program for static plane and axisymmetric analysis of structures in jointed rocks, 6:22732 (UCID—19047)
**Tensile Properties**
JPLAXD: a finite-element program for static plane and axisymmetric analysis of structures in jointed rocks, 6:22732 (UCID—19047)

**ROOF PONDS**
**Computerized Simulation**
Comfort conditions in roof pond cooled residences without air conditioners, 6:21911
**Heat Transfer**
Validation of heat transfer coefficients for passive cooling, 6:21930
**Performance**
Heat transfer in passively cooled buildings, 6:21886

**ROOTS**
**Membrane Transport**
Action of protein synthesis inhibitors in blocking electrogenic $H^+$ efflux from corn roots, 6:22663

**ROPES**
**Service Life**
Wire rope research and logging (Skyline and dragline systems), 6:22425 (PNL-SA—8797)

**ROTARY SEPARATOR TURBINES**
**Feasibility Studies**
Generation of useful energy from process fluids using the Biphase turbine. Final report, 6:22242 (DOE/ET/15350—1)
**Uses**
Generation of useful energy from process fluids using the Biphase turbine. Final report, 6:22242 (DOE/ET/15350—1)

**ROWE YANKEE REACTOR**
**Electrical Equipment**
Technical evaluation of the adequacy of station electric distribution system voltages for the Yankee Rowe Nuclear Power Station, 6:22028 (UCI—18966)

**RUBIDIUM HYDRIDES**
**Interatomic Forces**
Molecular potentials and relaxation dynamics, 6:22790 (UCRL—85577)
Molecular potentials and relaxation dynamics, 6:22791 (UCRL—85577(Rev.1))

**RUSSELLVILLE-2 ARKANSAS REACTOR**
*See ARKANSAS-2 REACTOR*

**RUTHENIUM**
**Electronic Structure**
Thermal desorption and UPS study of CO adsorbed on Cu-covered Ru (0001), 6:22289
**Spatial Distribution**
Redistribution of ruthenium in $UO_2$ in a temperature gradient, 6:22301 (LBL—12548)

**RUTHENIUM SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581

## S

**SABOTAGE**
**Safeguards**
Tamper recorder for unattended safeguards instruments, 6:21705

**SACCHARIDES**
*See also POLYSACCHARIDES*
**Chemical Reactions**
Reaction of sugar with nitric acid, 6:22333 (ORNL—5738)

**SACCHARIN**
**Biological Effects**
Lack of enhancement of chemical mutagenesis by saccharin in the Salmonella assay, 6:22713

**SACCHAROMYCES CEREVISIAE**
**Mutagenesis**
Mutagenicity of N-nitrosopiperazine derivatives in Saccharomyces cerevisiae, 6:22710

**SAFEGUARDS**
*See also DOMESTIC SAFEGUARDS*
*IAEA SAFEGUARDS*
Concepts on integration of physical protection and material accounting functions in a safeguards system, 6:21698 (SAND—81-0495C)
**Design**
Evolution of safeguards systems design, 6:21714
**Meetings**
Measurement technology for safeguards and materials control, proceedings from American Nuclear Society Topical Meeting, 1979, 6:21700
**Recording Systems**
Tamper recorder for unattended safeguards instruments, 6:21705
**Research Programs**
LASL analytical chemistry program for fissionable materials safeguards, 6:21718

**SAFETY (NUCLEAR)**
*See RADIATION PROTECTION*

**SALINITY GRADIENT POWER PLANTS**
**Research Programs**
Ocean energy conversion systems annual research report, 6:21843 (SERI/TR—634-1011)

**SALIVA**
**Qualitative Chemical Analysis**
Two-dimensional electrophoresis of human saliva, 6:22623

**SALMONELLA**
*See also SALMONELLA TYPHIMURIUM*
**Mutagenesis**
Lack of enhancement of chemical mutagenesis by saccharin in the Salmonella assay, 6:22713

**SALMONELLA TYPHIMURIUM**
**Gene Mutations**
In vivo conversion of sodium azide to a stable mutagenic metabolite in Salmonella typhimurium, 6:22642

**SALT DEPOSITS**
**Compression**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Inclusions**
Thermal-gradient migration of brine inclusions in salt, 6:22724 (LBL—12548)
**Poisson Ratio**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Shear Properties**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Stresses**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Yield Strength**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)
**Young Modulus**
Elastic-plastic deformation of anhydrite and polyhalite as determined from quasi-static triaxial compression tests, 6:22731 (SAND—81-7063)

**SALTING-OUT AGENTS**
Salting-out and multivalent cation precipitation of anionic surfactants, 6:21578

**SAMARIUM**
**Activation Analysis**
Flagstaff $1^0$ x $2^0$ NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon $1^0$ x $2^0$ NTMS area Arizona: data report, 6:21638 (GJBX—138(81))

**SAMARIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**SANDSTONES**
**Chemical Properties**
Chemical, physical, and mineralogical characterization of fifteen sandstones for radionuclide sorption studies, 6:21686 (UCID—19034)
**Explosive Fracturing**
Direct observation of explosively induced damage in sandstone with application to reservoir stimulation, 6:21605 (UCRL—85331(Rev.1))
**Mineralogy**
Chemical, physical, and mineralogical characterization of fifteen sandstones for radionuclide sorption studies, 6:21686 (UCID—19034)
**Petrography**
Chemical, physical, and mineralogical characterization of fifteen sandstones for radionuclide sorption studies, 6:21686 (UCID—19034)
**Physical Properties**
Chemical, physical, and mineralogical characterization of fifteen sandstones for radionuclide sorption studies, 6:21686 (UCID—19034)
**SANITARY LANDFILLS**
**Gas Flow**
Methane-production-rate studies and gas-flow modeling for the Fresh Kills landfill, 6:21728 (NYSERDA—80-21)
**SATELLITE POWER SYSTEM**
*See ORBITAL SOLAR POWER PLANTS*
**SATELLITE SOLAR POWER STATIONS**
*See ORBITAL SOLAR POWER PLANTS*
**SAVANNAH RIVER PLANT**
**Ashes**
Clay mineralogy of selected sediments and soils at the Savannah River Plant, Aiken, South Carolina, 6:22729 (DP-MS—80-119)
**Fly Ash**
Clay mineralogy of selected sediments and soils at the Savannah River Plant, Aiken, South Carolina, 6:22729 (DP-MS—80-119)
**Quality Assurance**
NDA for the SRP fuel fabrication process, 6:21706
**Sediments**
Clay mineralogy of selected sediments and soils at the Savannah River Plant, Aiken, South Carolina, 6:22729 (DP-MS—80-119)
**Soils**
Clay mineralogy of selected sediments and soils at the Savannah River Plant, Aiken, South Carolina, 6:22729 (DP-MS—80-119)
**SCALARS**
**Advection**
Examination of some simple numerical schemes for calculating scalar advection, 6:22531
**SCANDIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**SCANDIUM HYDRIDES**
**Auger Electron Spectroscopy**
Detection of a $ScD_2$ film decomposition by AES, 6:22321
**Decomposition**
Detection of a $ScD_2$ film decomposition by AES, 6:22321
**SCANNING ELECTRON MICROSCOPY**
Analytical transmission electron microscopy in minerals processing, 6:21536 (DOE/ER/01198—1351)
**SCHOOL BUILDINGS**
**Energy Analysis**
DOE-2 Verification Project. Phase I. Interim report, 6:22205 (LA—8295-MS)
**Energy Consumption**
DOE-2 Verification Project. Phase I. Interim report, 6:22205 (LA—8295-MS)
**Solar Space Heating**
Performance comparison of solar space heating systems of selected active sites in the National Solar Data Network, 6:21867 (SOLAR/0005—81/80)
**Solar Water Heating**
Performance comparison of solar space heating systems of selected active sites in the National Solar Data Network, 6:21867 (SOLAR/0005—81/80)
**SCHOTTKY BARRIER DIODES**
**Electrical Properties**
Investigation of solar cells based on $Cu_2O$. Progress report, June 1, 1980-November 30, 1980, 6:21786 (SERI/PR—9190-1-T1)
**SCHROEDINGER EQUATION**
**Hamiltonians**
WKB approximation for general matrix Hamiltonians, 6:22871
**WKB Approximation**
WKB approximation for general matrix Hamiltonians, 6:22871
**SCREWS**
*See FASTENERS*
**SEA DISPOSAL**
*See MARINE DISPOSAL*
**SEALING MATERIALS**
Development of alternate silicone potting compounds. Volume 8. Development of an alternate substitute for Dow Corning aerospace sealant DC93-122 based on Sylgard 184 and dielectric gel Q3-6527, 6:22306 (UCRL—52434(Vol.8))
**SEAWATER**
**Water Chemistry**
Chemical and isotopic evidence for the in situ origin of marine humic substances, 6:22578
**SEBACEOUS GLANDS**
*See SKIN*
**SEDIMENTS**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Chemical Analysis**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Chemical Composition**
Early diagenesis in a reducing fjord, Saanich Inlet, British Columbia. I. Chemical and isotopic changes in major components of interstitial water, 6:22574
Early diagenesis in a reduced fjord, Saanish Inlet, British Columbia. III. Changes in organic constituents of sediment, 6:22581
Interstitial water chemistry: Deep Sea Drilling Project, Leg 11, 6:22579
Interstitial water chemistry, Leg 12, 6:22576
Interstitial water chemistry: Deep Sea Drilling Project, Leg 14, 6:22580
Interstitial water chemistry: Deep Sea Drilling Project, Leg 10, 6:22577
**Diagenesis**
Early diagenesis in a reducing fjord, Saanich Inlet, British Columbia. I. Chemical and isotopic changes in major components of interstitial water, 6:22574
Early diagenesis in a reduced fjord, Saanish Inlet, British Columbia. III. Changes in organic constituents of sediment, 6:22581
**Particle Resuspension**
Fate of sedimented organic carbon in estuaries, 6:22568 (CONF-8009140—)
**Radioactivity**
Radiocarbon in New York Bight sediments and the use of carbon isotopes in delineating carbon sources, 6:22569 (CONF-8009140—)

**Sampling**
Rate of denudation in Black Sea source area, 6:22561 (CONF-8009140—)
**SEISMIC SURVEYS**
**Comparative Evaluations**
Applications of reflection seismics to mapping coal-seam structure and discontinuities, 6:21546 (SAND—81-1069C)
**SELENIUM COMPLEXES**
**Mutagenesis**
Quantitative mammalian cell mutagenesis and a preliminary study of the mutagenic potential of metallic compounds, 6:22715
**SELF-CONSISTENT FIELD**
General quadratically convergent MCSCF theory in terms of reduced matrix elements, 6:22783 (LBL—12157)
Generalized molecular orbital theory: a limited multiconfiguration self-consistent-field-theory, 6:22780 (LBL—12157)
**Comparative Evaluations**
Formal and numerical convergence comparison of SCI and exponential methods, 6:22785 (LBL—12157)
**Configuration Interaction**
Loop-driven graphical unitary group approach applied to the MCSCF problem, 6:22779 (LBL—12157)
Quadratically convergent MCSCF theory for large configuration sets, 6:22778 (LBL—12157)
**Meetings**
Recent developments and applications of multi-configuration Hartree-Fock methods. NRCC proceedings No. 10, 6:22777 (LBL—12157)
**Optimization**
MCSCF optimization through iterative CI calculations in the single excitation space and MCSCF wave functions in the full reaction space, 6:22781 (LBL—12157)
**SEM (MICROSCOPY)**
*See SCANNING ELECTRON MICROSCOPY*
**SEMICONDUCTOR DIODES**
**Charge Transport**
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells. Quarterly technical progress report No. 2, 1 November 1980-31 January 1981, 6:21788 (SERI/PR—9234-2-T1)
**Fabrication**
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells. Quarterly technical progress report No. 2, 1 November 1980-31 January 1981, 6:21788 (SERI/PR—9234-2-T1)
**SENIOR CENTERS**
*See PUBLIC BUILDINGS*
**SENSIBLE HEAT STORAGE**
**Economic Analysis**
Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)
**Environmental Impacts**
Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)
**Feasibility Studies**
Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)
**Legal Aspects**
Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)
**Performance Testing**
Focusing solar air heater with rock storage, 6:21951
**Technology Assessment**
Seasonal thermal energy storage program. Progress report, January 1980-December 1980, 6:22089 (PNL—3746)
**SEQUESTRENE**
*See EDTA*
**SEWAGE**
**Acute Irradiation**
Irradiation of microorganism such as bacteria and viruses in the presence of chemical enhancing agent, 6:22696
**Waste Processing**
Irradiation of microorganism such as bacteria and viruses in the presence of chemical enhancing agent, 6:22696
**SEWAGE SLUDGE**
**Anaerobic Digestion**
Evaluation of mixing systems for biogasification of municipal solid waste, 6:22256 (DOE/CS/20100—T2)
Full scale field demonstration of unheated anaerobic contact stabilization. Project status report, October 1980-February 1981, 6:21726 (DOE/CS/24310—3)
**Mixing**
Evaluation of mixing systems for biogasification of municipal solid waste, 6:22256 (DOE/CS/20100—T2)
**Solar Drying**
Active solar systems technology, 6:21942 (LA—8797-PR)
**SHADING**
**Regulations**
Guide to passive cooling: model shading ordinance, 6:22168
**Standards**
Guide to passive cooling: model shading ordinance, 6:22168
**SHAFT EXCAVATIONS**
*See also RADIOACTIVE WASTE DISPOSAL*
**Research Programs**
The US Department of Energy's coal mining research, 6:21554
**SHALE OIL**
**Chemical Analysis**
Determination of sulfur heterocycles in coal liquids and shale oils, 6:21537
Separation of nitrogen compound types from hydrotreated shale oil products by adsorption chromatography on basic and neutral alumina, 6:21613
**Fractionation**
Comparison of chemical and mutagenic properties of a coal liquid and a shale oil, 6:21516 (PNL-SA—8812)
**Mutagen Screening**
Comparison of chemical and mutagenic properties of a coal liquid and a shale oil, 6:21516 (PNL-SA—8812)
Studies of the biology and toxicology of oilshale materials, 6:22705 (LA-UR—81-1166)
**Toxicity**
Studies of the biology and toxicology of oilshale materials, 6:22705 (LA-UR—81-1166)
**SHALES**
*See also OIL SHALES*
*SPENT SHALES*
**Thermal Conduction**
Finite element model for heat conduction in jointed rock masses, 6:21684 (SAND—80-2016)
**SHELLS**
**Aspect Ratio**
Furnace profile effects on glass shell formation, 6:22949
**Temperature Effects**
Furnace profile effects on glass shell formation, 6:22949
**SHIELDS**
**Radiation Absorption Analysis**
Multi-energy gamma-ray automated scanning system, 6:22328 (LA-UR—81-1511)
**SHIPPINGPORT REACTOR**
**Environmental Effects**
1980 annual radiological environmental report. Volume 2, 6:22057 (DOE/PN/00293—T1)
**Reactor Cores**
Summary of the thermal evaluation of LWBR (LWBR Development Program), 6:22041 (WAPD-TM—1385)
**SHOCK WAVES**
**Wave Propagation**
Project PROPA-GATOR: intermediate range explosion airblast propagation measurements, 6:22526 (SAND—80-1880C)
**SHOWER COUNTERS**
*(Detects high energy gamma radiation or high energy particles on basis of cascade showers in layered absorbers.)*
**Readout Systems**
Hybrid shower counters for CDF, 6:22514
**SIGMA NEUTRAL**
**Magnetic Moments**
Precise measurement of the $J^0$ magnetic moment, 6:22818

**SIGMA PLUS**
**Particle Production**
Polarization of $S^+$ hyperons produced by 400-GeV protons, 6:22821
**SIGMALOG**
*See MWD SYSTEMS*
**SILANES**
**Carrier Mobility**
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
**Electrical Properties**
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
**Energy-Level Density**
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
**Field Emission**
Atom probe analysis of rf-sputtered a-Si:H films, 6:22325
**Ion Microscopy**
Atom probe analysis of rf-sputtered a-Si:H films, 6:22325
**Sputtering**
Atom probe analysis of rf-sputtered a-Si:H films, 6:22325
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
**Thermal Cracking**
Surface chemistry of epitaxial silicon deposition by thermal cracking of silane, 6:22313 (LBL—12548)
**SILICATES**
**Density**
Partial molar volumes of oxide components in silicate liquids, 6:22734
**Viscosity**
Dynamic viscosity of some silicate melts to 1688°C under atmospheric pressure, 6:22733
**SILICON**
**Absorptivity**
Optical-absorption measurements of pure and heavily doped silicon from 1.24 to 4.63 eV and the effect on solar-cell performance, 6:21758 (CONF-810526—26(Draft))
**Adsorption**
Oxidation of Si(111), 7 x 7 and 2 x 1: A comparison, 6:22323
**Annealing**
Atomic structure of laser annealed Si(111)—(1 x 1), 6:22324
**Atom Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Carrier Mobility**
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Final technical report, July 1, 1979-June 30, 1980, 6:22311 (DOE/ET/23037—4)
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, January-March 31, 1980, 6:21764 (DOE/ET/23037—3)
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
**Chemical Reactions**
Critical conditions for the growth of SiC, $Si_3N_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981, 6:22295 (DOE/ER/10438—T1)
**Chemical Vapor Deposition**
Development of a polysilicon process based on chemical vapor deposition (Phase 1). Fifth quarterly progress report, 1 October-31 December 1980, 6:21769 (DOE/JPL/955533—81/5)
**Crystal Defects**
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells. Quarterly technical progress report No. 2, 1 November 1980-31 January 1981, 6:21788 (SERI/PR—9234-2-T1)
**Crystal Growth**
Development of advanced Czochralski growth process to produce low-cost 150-kg silicon ingots from a single crucible for technology readiness. First quarterly progress report, October 1, 1980-December 31, 1980, 6:21771 (DOE/JPL/955733—80/1)
**Crystal Structure**
Atomic structure of laser annealed Si(111)—(1 x 1), 6:22324
**Deposition**
Surface chemistry of epitaxial silicon deposition by thermal cracking of silane, 6:22313 (LBL—12548)
**Electrical Properties**
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
**Electron Diffraction**
Atomic structure of laser annealed Si(111)—(1 x 1), 6:22324
**Energy Gap**
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, January-March 31, 1980, 6:21764 (DOE/ET/23037—3)
**Energy-Level Density**
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Final technical report, July 1, 1979-June 30, 1980, 6:22311 (DOE/ET/23037—4)
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
**Hydrogenation**
Sputtered amorphous silicon solar cells. Quarterly report No. 2, October 22, 1980-January 22, 1981, 6:21787 (SERI/PR—9219-T1)
**Lithium Additions**
Effect of lithium diffusion into polycrystalline Si solar cells, 6:21759 (CONF-810526—27)
**Molecule Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Optical Properties**
Optical-absorption measurements of pure and heavily doped silicon from 1.24 to 4.63 eV and the effect on solar-cell performance, 6:21758 (CONF-810526—26(Draft))
**Photoelectron Spectroscopy**
Oxidation of Si(111), 7 x 7 and 2 x 1: A comparison, 6:22323
**Process Development Units**
Development of a polysilicon process based on chemical vapor deposition (Phase 1). Fifth quarterly progress report, 1 October-31 December 1980, 6:21769 (DOE/JPL/955533—81/5)
Low cost solar array project. Quarterly progress report, January-March, 1981, 6:21765 (DOE/JPL/954334—18)
**Sputtering**
Amorphous thin films for solar-cell applications. Technical progress report, 11 October 1980 to 15 January 1981, 6:21789 (SERI/PR—9237-1-T2)
Determination of pseudogap state density and carrier mobility in rf sputtered amorphous silicon. Quarterly technical progress report, October 1-December 31, 1979, 6:21763 (DOE/ET/23037—2)
**SILICON ALLOYS**
**Production**
Production of aluminum-silicon alloy and ferrosilicon and commercial purity aluminum by the direct reduction process. First interim technical report, Phase D, January 1-March 31, 1981, 6:22266 (CONS—5089-15)
**SILICON CARBIDES**
**Chemical Vapor Deposition**
Chemically vapor deposited coatings for multibarrier containment of nuclear wastes, 6:21661 (CONF-8005107—)

**Defects**
Infrared techniques for the evaluation of silicon carbide heat-exchanger tubing, 6:22447
**Erosion**
Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report, 6:21497 (DOE/ET/13537—T3)
**Infrared Thermography**
Infrared techniques for the evaluation of silicon carbide heat-exchanger tubing, 6:22447

**SILICON COMPOUNDS**
**Bending**
High temperature applications of structural ceramics. Quarterly progress report, January-March 1981, 6:22296 (DOE/OR/20679—T4)

**SILICON FLUORIDES**
**Dissociation**
Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)
**Photon-Molecule Collisions**
Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)

**SILICON HYDRIDES**
*See SILANES*

**SILICON IONS**
**Energy-Level Transitions**
Recent results in $\Delta n = 0$, $n = 2$ transitions of helium-like systems, 6:22765 (ANL—80-126)

**SILICON NITRIDES**
Chemical information from Auger electron spectroscopy, 6:22348
**Chemical Preparation**
Critical conditions for the growth of SiC, $Si_3N_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981, 6:22295 (DOE/ER/10438—T1)
**Chemical Vapor Deposition**
Solid-state processes to produce hemispherical components for inertial fusion targets, 6:22933

**SILICON OXIDES**
*See also QUARTZ*
**Chemical Preparation**
Critical conditions for the growth of SiC, $Si_3N_4$, and $SiO_2$. Progress report, June 1, 1980-May 31, 1981, 6:22295 (DOE/ER/10438—T1)
**Vapor Plating**
Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils, 6:21999 (DOE/ET/12292—T1)

**SILICON SOLAR CELLS**
**Capacitance**
Amorphous silicon solar cells. Quarterly report No. 1, 1 October 1980-31 December 1980, 6:21791 (SERI/PR—9372-1-T1)
**Encapsulation**
Process development for automated solar-cell and module production. Task 4. Automated array assembly. Quarterly report No. 3, 6:21770 (DOE/JPL/955699—81/03)
**Fabrication**
Amorphous silicon solar cells. Quarterly report No. 1, 1 October 1980-31 December 1980, 6:21791 (SERI/PR—9372-1-T1)
Amorphous thin films for solar-cell applications. Technical progress report, 11 October 1980 to 15 January 1981, 6:21789 (SERI/PR—9237-1-T2)
Analysis and evaluation in the production process and equipment area of the low-cost solar-array project. Quarterly report, July-October, 1980, 6:21767 (DOE/JPL/954796—81/12)
Feasibility study of a microwave application for solar-cell fabrication. Annual report for period ending February, 1981, 6:21781 (SERI/PR—8041-16-T1)
Performance improvement of silicon sheet solar cells by process optimization, 6:21803
Process development for automated solar-cell and module production. Task 4. Automated array assembly. Quarterly report No. 3, 6:21770 (DOE/JPL/955699—81/03)
Silicon solar cell process development, fabrication, and analysis. Eighth quarterly report, 1 October 1980-31 December 1980, 6:21768 (DOE/JPL/955089—80/10)
Sputtered amorphous silicon solar cells. Quarterly report No. 2, October 22, 1980-January 22, 1981, 6:21787 (SERI/PR—9219-T1)
**Feasibility Studies**
MIS silicon solar cells: potential advantages, 6:21793 (SERI/TP—612-1190)
**Mathematical Models**
Amorphous silicon solar cells. Quarterly report No. 1, 1 October 1980-31 December 1980, 6:21791 (SERI/PR—9372-1-T1)
**Performance**
Effect of lithium diffusion into polycrystalline Si solar cells, 6:21759 (CONF-810526—27)
Optical-absorption measurements of pure and heavily doped silicon from 1.24 to 4.63 eV and the effect on solar-cell performance, 6:21758 (CONF-810526—26(Draft))
Performance improvement of silicon sheet solar cells by process optimization, 6:21803
Silicon solar cell process development, fabrication, and analysis. Eighth quarterly report, 1 October 1980-31 December 1980, 6:21768 (DOE/JPL/955089—80/10)
**Reviews**
MIS silicon solar cells: potential advantages, 6:21793 (SERI/TP—612-1190)

**SILVER**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Frenkel Defects**
Defect clustering in copper, silver and aluminium during heavy-ion irradiations at low temperatures (AR or Kr ions, or 150 kev protons), 6:22272
**Krypton 84 Reactions**
Rigid rotation and l-wave fractionation in the deep-inelastic reaction: 664 MeV $^{84}Kr+$/sup nat/Ag, 6:22851

**SITE SELECTION**
**Decision Making**
Energy conservation through site planning: a systems approach, 6:22557 (CONF-810531—1)
**Socio-Economic Factors**
Application of the SELECS methodology to evaluate socioeconomic and environmental impacts of commercial-scale coal liquefaction plants at six potential sites in Kentucky. Final report from the study on development of environmental guidelines for the selection of sites for fossil energy conversion facilities, 6:21542 (DOE/ET/10466—T1)

**SKELETON**
**Dynamic Function Studies**
Prediction of skeletal mass in growing and adult beagles, 6:22656

**SKIN**
**Bioassay**
Tumorigenesis of diesel exhaust, gasoline exhaust, and related emission extracts on SENCAR mouse skin, 6:22702 (CONF-800323—4)
**Pathological Changes**
Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age, 6:22677 (FDA—81-8042)

**SLAGS**
**Fluid Flow**
Detailed description of technical progress task 1, arcing phenomena in MHD generators, 6:22146 (DOE/ET/15518—3)

**SLOT OVENS**
*See COKE OVENS*

**SLUGS (FUEL)**
*See FUEL RODS*

**SODIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))

Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)
**Emission Spectroscopy**
Laser-induced breakdown spectroscopy: detecting sodium and potassium in coal gasifiers, 6:22329 (LA-UR—81-1526)
**Laser Spectroscopy**
Laser-induced breakdown spectroscopy: detecting sodium and potassium in coal gasifiers, 6:22329 (LA-UR—81-1526)
**Membrane Transport**
Lymphocyte sodium concentration regulates monovalent cation transport after PHA stimulation, 6:22643
**Oscillator Strengths**
Analytic representation of the dipole oscillator-strength distribution, 6:22802
**SODIUM HYDRIDES**
**Interatomic Forces**
Molecular potentials and relaxation dynamics, 6:22790 (UCRL—85577)
Molecular potentials and relaxation dynamics, 6:22791 (UCRL—85577(Rev.1))
**SODIUM-SULFUR BATTERIES**
**Solid Electrolytes**
Failure modes of Na-beta alumina, 6:22091 (LBL—12445)
**SOILS**
**Chemical Analysis**
Approaches to estimating microbial degradation of chemical contaminants in freshwater ecosystems, 6:22586
**Heat Storage**
Ground coupling and single-blow thermal storage in a double-envelope house, 6:22169 (BNL—29480)
**Leaching**
Terrestrial sources of organic carbon, 6:22554 (CONF-8009140—)
**Mineral Cycling**
Use of carbon isotope measurements to examine the movement of labile and refractory carbon in soil, 6:22555 (CONF-8009140—)
**Natural Radioactivity**
Development of some natural matrix standards - progress report, 6:22331
**Sample Preparation**
Development of some natural matrix standards - progress report, 6:22331
**Temperature Distribution**
Ground coupling and single-blow thermal storage in a double-envelope house, 6:22169 (BNL—29480)
**SOLAR ABSORBERS**
**Spectrally Selective Surfaces**
Toward efficiency at the interface: spectrally selective surfaces for photothermal conversion, 6:21952
**SOLAR AIR CONDITIONERS**
**Absorption Refrigeration Cycle**
Proprties of the Carrol system and a machine design for solar-powered, air-cooled, absorption space cooling. Phase I and Phase II. Final report, September 1977-March 1979, 6:21851 (DOE/CS/31587—T2)
**Working Fluids**
Proprties of the Carrol system and a machine design for solar-powered, air-cooled, absorption space cooling. Phase I and Phase II. Final report, September 1977-March 1979, 6:21851 (DOE/CS/31587—T2)
**SOLAR AIR CONDITIONING**
Status and prospects of local solar heating and cooling systems, 6:21933
**SOLAR AIR HEATERS**
**Performance**
Analysis and performance evaluation of an air thermosyphon system, 6:21908
Assessment of air solar system performance with alternate methods of analysis, 6:21872 (SOLAR/0005—81/80)
**Performance Testing**
Focusing solar air heater with rock storage, 6:21951
**Simulation**
Analysis and performance evaluation of an air thermosyphon system, 6:21908
**Thermosyphon Effect**
Analysis and performance evaluation of an air thermosyphon system, 6:21908
**SOLAR ARCHITECTURE**
Moving passive into the mass market: the Acorn/Massdesign passive prototype, 6:21898
Passive Solar Systems, 6:21861 (LA—8797-PR)
**Education**
Passive education for active professionals: a review of the effectiveness of the passive studio, 6:21891
**SOLAR CELL ARRAYS**
*See also COMBINED COLLECTORS*
*PHOTOVOLTAIC POWER SUPPLIES*
**Bibliographies**
Solar photovoltaics: a bibliography with abstracts, 6:21795 (TAC/SP—80-004)
**Computer Codes**
Cell string model with mirror gap shading for a parabolic-trough photovoltaic collector, 6:21775 (SAND—81-0069)
**Corrosion**
Study program for encapsulation materials interface for low-cost solar array. Annual report, January 1, 1980-December 31, 1980, 6:21766 (DOE/JPL/954739—4)
**Cost**
Array subsystem development for photovoltaic-array fields, 6:21824 (SAND—81-1193C)
**Design**
Array subsystem development for photovoltaic-array fields, 6:21824 (SAND—81-1193C)
**Electrical Properties**
Study program for encapsulation materials interface for low-cost solar array. Annual report, January 1, 1980-December 31, 1980, 6:21766 (DOE/JPL/954739—4)
**Fabrication**
Process development for automated solar-cell and module production. Task 4. Automated array assembly. Quarterly report No. 3, 6:21770 (DOE/JPL/955699—81/03)
**Mathematical Models**
Cell string model with mirror gap shading for a parabolic-trough photovoltaic collector, 6:21775 (SAND—81-0069)
**Performance**
Application potentials for flat plate and concentrator photovoltaic collectors, 6:21834
Progress in the performance of terrestrial solar cell modules, 6:21832
Simplified method for predicting photovoltaic array output, 6:21804
**Performance Testing**
Performance criteria and test standards for photovoltaic arrays, 6:21831
Real-time performance testing of photovoltaic-concentrator modules, 6:21776 (SAND—81-1145C)
**Uses**
Application potentials for flat plate and concentrator photovoltaic collectors, 6:21834
**Wind Loads**
Wind loads on photovoltaic arrays, 6:21833
**SOLAR CELL RECEIVERS**
*See SOLAR RECEIVERS*
**SOLAR CELLS**
*See also CADMIUM SULFIDE SOLAR CELLS*
*CONCENTRATOR SOLAR CELLS*
*GALLIUM ARSENIDE SOLAR CELLS*
*INDIUM PHOSPHIDE SOLAR CELLS*
*SILICON SOLAR CELLS*
*ZINC PHOSPHIDE SOLAR CELLS*
**Bibliographies**
Solar photovoltaics: a bibliography with abstracts, 6:21795 (TAC/SP—80-004)
**Efficiency**
Thin-film polycrystalline $Cu_2S$/Cd/sub 1-x/Zn/sub x/ S solar cells of 10% efficiency, 6:21796
**Electrical Properties**
Investigation of solar cells based on $Cu_2O$. Progress report, June 1, 1980-November 30, 1980, 6:21786 (SERI/PR—9190-1-T1)

**Fabrication**
Thin-film polycrystalline $Cu_2S$/Cd/sub 1-x/Zn/sub x/ S solar cells of 10% efficiency, 6:21796
**Graded Band Gaps**
Efficient use of the slar spectrum through the multiple junction cascade solar cell, 6:21802
**Performance Testing**
Performance measurement reference conditions for terrestrial photovoltaics, 6:21836
Reference conditions for reporting terrestrial photovoltaic performance, 6:21830
**Socio-Economic Factors**
Photovoltaics, 6:21772 (PNL-SA—9464)
**Spectral Response**
Performance measurement reference conditions for terrestrial photovoltaics, 6:21836

**SOLAR COLLECTORS**
*See also COMBINED COLLECTORS*
*CONCENTRATING COLLECTORS*
*EVACUATED TUBE COLLECTORS*
*FLAT PLATE COLLECTORS*
*PARABOLIC TROUGH COLLECTORS*
*SOLAR AIR HEATERS*
*SOLAR PONDS*
*TOWER FOCUS COLLECTORS*
**Certification**
Interstate Solar Coordination Council. Final report, 6:21736 (DOE/CS/30278—T4)
**Corrosion**
Active solar systems technology, 6:21942 (LA—8797-PR)
**Installation**
Guidelines for the installation of solar components on low-sloped roofs, 6:21944 (NBS-TN—1134)
**Materials Testing**
Initial experience and preliminary results: solar collector materials exposure to the IPH site environment, 6:21946 (SAND—81-0290)
**Optical Properties**
Initial experience and preliminary results: solar collector materials exposure to the IPH site environment, 6:21946 (SAND—81-0290)

**SOLAR CONCENTRATORS**
*See also COMPOUND PARABOLIC CONCENTRATORS*
*FRESNEL LENS*
**Control Systems**
Tracking instrument and control for solar concentrators. Final technical report, October 1979-January 1981, 6:21941 (DOE/ET/21109—T1)

**SOLAR COOLING SYSTEMS**
*See also SOLAR AIR CONDITIONERS*
**Computerized Simulation**
Direct contact liquid-liquid heat exchanger for solar-heated and -cooled buildings. Final report, January 1, 1979-May 30, 1980, 6:21852 (DOE/CS/32867—T1)
**Data Acquisition**
Validation of remotely sensed data from a large network of solar heating and cooling installations, 6:21873 (SOLAR/0005—81/80)
**Direct Contact Heat Exchangers**
Direct contact liquid-liquid heat exchanger for solar-heated and -cooled buildings. Final report, January 1, 1979-May 30, 1980, 6:21852 (DOE/CS/32867—T1)
**Information Validation**
Validation of remotely sensed data from a large network of solar heating and cooling installations, 6:21873 (SOLAR/0005—81/80)
**Marketing Research**
Diffusion of solar energy technologies in the new-construction market: a survey of new solar-home and onventional-home buyers, 6:21853 (DOE/EIA/10189—T2)
**Performance**
Long-term performance trends for ten solar systems monitored by the national solar data network, 6:21869 (SOLAR/0005—81/80)
National solar data program performance results, Volume II, 6:21866 (SOLAR/0005—81/80)

**SOLAR CORONA**
**X Radiation**
Analyais of solar X-ray emission line profiles, 6:22742

**SOLAR CYCLE**
**Weather**
Mechanism for the effects of variable solar activity on the weather. Final report, 6:22738 (DOE/ER/04634—1)

**SOLAR DRYERS**
**Annual Energy Storage**
Performance of an experimental annual cycle solar regenerated desiccant crop dryer, 6:21880
**Performance**
Corn drying with solar-dried desiccant, 6:21879
Performance of an experimental annual cycle solar regenerated desiccant crop dryer, 6:21880

**SOLAR DRYING**
**Meetings**
Agricultural energy. Vol. 1. Solar energy livestock production, 6:21878

**SOLAR ENERGY**
**Attitudes**
California solar energy study: decision-analysis panel report, 6:21738 (DOE/EIA/10189—T3)
**Budgets**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Education**
Solar training for women, a feminist perspective, 6:21739
**Financial Data**
Revised congressional budget request, FY 1982. Conservation and renewable energy program, 6:22166 (DOE/CE—0002)
**Financial Incentives**
Incentives for solar energy in industry, 6:21747 (SAND—81-0048)
Solar diffusion in California: a pilot study. Consultant report, 6:21737 (DOE/EIA/10189—T1)
**Government Policies**
Consumer experience: implications for government solar policy, 6:21756
**Interest Groups**
Interstate Solar Coordination Council. Final report, 6:21736 (DOE/CS/30278—T4)
**Latent Heat Storage**
Energy storage in organic photoisomers, 6:21809
**Legal Incentives**
Solar diffusion in California: a pilot study. Consultant report, 6:21737 (DOE/EIA/10189—T1)
**Meetings**
5th national passive solar conference, 6:21885
Passive systems, physics, socio-economics, solar radiation, wind power, 6:21740
**Photochemical Energy Storage**
Energy storage in organic photoisomers, 6:21809
**Public Information**
Developing community networking utilizing the first weekly solar energy radio program, 6:21757
**Public Opinion**
California solar energy study: decision-analysis panel report, 6:21738 (DOE/EIA/10189—T3)
Public opinion about energy (Review), 6:22103
Solar diffusion in California: a pilot study. Consultant report, 6:21737 (DOE/EIA/10189—T1)
**Public Policy**
Capturing the sun's energy: opportunities for local governments, 6:21750
**Public Relations**
Overcoming the non-technical barriers to the acceptance and utilization of passive solar energy through education and promotional activities, 6:21892
**Regulations**
Guide to the adoption of energy conservation retrofit ordinances, 6:22111
**Social Impact**
Women: the key to a passive solar society, 6:22601

**SOLAR ENERGY CONVERSION**
Monolayer films of surfactant derivatives of methylene blue, 6:21808
**Photochemical Reactions**
Principles of photoelectrochemical, solar energy conversion, 6:21798

**SOLAR EQUIPMENT**
*See also PHOTOELECTROCHEMICAL CELLS*
*PHOTOVOLTAIC POWER SUPPLIES*
*SOLAR ABSORBERS*
*SOLAR CELL ARRAYS*
*SOLAR CELLS*
*SOLAR COLLECTORS*
*SOLAR COOLING SYSTEMS*
*SOLAR DRYERS*
*SOLAR FURNACES*
*SOLAR HEATING SYSTEMS*
*SOLAR WATER HEATERS*
*SPECTRALLY SELECTIVE SURFACES*
**Marketing Research**
Solar diffusion in California: a pilot study. Consultant report, 6:21737 (DOE/EIA/10189—T1)
**Performance**
Experiences of residential solar energy users: a review of empirical research, 6:21754
**SOLAR FLUX**
*See also DIFFUSE SOLAR RADIATION*
*INSOLATION*
Geometrical vector flux sinks and ideal flux concentrators, 6:21950
**Energy Spectra**
Seasonal variation in the solar spectrum, 6:21743
**SOLAR FURNACES**
Proposed solar-furnace study of zinc sulfate decomposition, 6:21722 (UCRL—85743)
**SOLAR HEATING SYSTEMS**
*See also PASSIVE SOLAR HEATING SYSTEMS*
*SOLAR-ASSISTED HEAT PUMPS*
Solar poultry brooding research at the Southeast Poultry Research Laboratory: a progress report, 6:21883
**Attitudes**
Conventional HVAC contractors: convincing the competition to join the solar movement, 6:21755
**Computer Calculations**
F-Chart/SLR: an interactive program for determining the performance of active and passive solar buildings, 6:21926
**Computerized Simulation**
Direct contact liquid-liquid heat exchanger for solar-heated and -cooled buildings. Final report, January 1, 1979-May 30, 1980, 6:21852 (DOE/CS/32867—T1)
Solar space heating a growing-finishing swine building without added thermal storage, 6:21882
**Control Systems**
Analysis, simulation and diagnosis of solar energy control system anomalies, 6:21870 (SOLAR/0005—81/80)
Solar energy management system, 6:21934
**Cost**
Solar project description for Matt Cannon multi-unit apartment, Gainesville, Florida (Includes glossary), 6:21935 (SOLAR/1044—80/50)
**Data Acquisition**
Validation of remotely sensed data from a large network of solar heating and cooling installations, 6:21873 (SOLAR/0005—81/80)
**Design**
Building space heating: active systems, 6:21915
Solar project description for Matt Cannon multi-unit apartment, Gainesville, Florida (Includes glossary), 6:21935 (SOLAR/1044—80/50)
**Direct Contact Heat Exchangers**
Direct contact liquid-liquid heat exchanger for solar-heated and -cooled buildings. Final report, January 1, 1979-May 30, 1980, 6:21852 (DOE/CS/32867—T1)
**Economic Analysis**
Solar energy system economic evaluation. Final report for SEECO Lincoln, Lincoln, Nebraska, 6:21854 (DOE/NASA/CR—161724)
Solar Energy System Economic Evaluation final report for Colt Pueblo, Pueblo, Colorado, 6:21855 (DOE/NASA/CR—161725)
Solar Energy System Economic Evaluation final report for IBM System 4, Clinton, Mississippi, 6:21856 (DOE/NASA/CR—161726)
Solar energy system economic evaluation. Final report for IBM system 3, Glendo, Wyoming, 6:21857 (DOE/NASA/CR—161728)
**Economics**
Economics of solar energy systems: short term costing, 6:21749
**Energy Analysis**
Energy-resource requirements of a solar-heating system, 6:21865 (NP—1902600)
**Information Validation**
Validation of remotely sensed data from a large network of solar heating and cooling installations, 6:21873 (SOLAR/0005—81/80)
**Marketing Research**
Diffusion of solar energy technologies in the new-construction market: a survey of new solar-home and onventional-home buyers, 6:21853 (DOE/EIA/10189—T2)
**Materials**
Energy-resource requirements of a solar-heating system, 6:21865 (NP—1902600)
**Off-Peak Energy Storage**
Technical and financial aspects of electric utility peak load reduction through solar space heating system controls, 6:21931
**Operation**
Solar heating of poultry laying houses in the northern states, 6:21884
**Performance**
Assessment of air solar system performance with alternate methods of analysis, 6:21872 (SOLAR/0005—81/80)
Building space heating: active systems, 6:21915
Long-term performance trends for ten solar systems monitored by the national solar data network, 6:21869 (SOLAR/0005—81/80)
National solar data program performance results, Volume II, 6:21866 (SOLAR/0005—81/80)
Performance comparison of solar space heating systems of selected active sites in the National Solar Data Network, 6:21867 (SOLAR/0005—81/80)
Solar energy system performance evaluation, October 1979-April 1980: Bond Construction, Gladstone, Missouri, 6:21876 (SOLAR/1050—81/14)
**Solar-Assisted Heat Pumps**
Hybrid photovoltaic/thermal systems with a solar-assisted heat pump, 6:21826
**SOLAR NEUTRINOS**
**Neutrino Detection**
Solar neutrino experiments and neutrino oscillations, 6:22736 (BNL—29440)
**Oscillations**
Solar neutrino experiments and neutrino oscillations, 6:22736 (BNL—29440)
**SOLAR PONDS**
*See also ROOF PONDS*
**Mathematical Models**
Solar ponds, 6:21943 (LA—8797-PR)
**Reviews**
Solar ponds, 6:21949 (SERI/TR—731-587)
**SOLAR POWER PLANTS**
*See also OCEAN THERMAL POWER PLANTS*
*ORBITAL SOLAR POWER PLANTS*
*PHOTOVOLTAIC POWER PLANTS*
*SOLAR THERMAL POWER PLANTS*
**Marketing Research**
Northeast regional assessment study for solar electric options in the period 1980-2000, 6:21837 (DOE/ET/20375—T1)
**Research Programs**
Advanced Power Systems Division (Report section), 6:22136 (EPRI-P—1726-SR)
**SOLAR PROCESS HEAT**
**Data Acquisition Systems**
Status report on the project for a standardized data acquisition system, 6:21877 (UCID—18893)
**Demonstration Programs**
Industrial process heat, 6:21916
**SOLAR RECEIVERS**
*See also CENTRAL RECEIVERS*
**Design**
Low-cost, actively-cooled linear photovoltaic receiver, 6:21780 (SAND—81-7113C)

**SOLAR SPACE HEATING**
Status and prospects of local solar heating and cooling systems, 6:21933
**Economic Analysis**
Economics of electric utility backup for solar heating and hot water, 6:21748
**Meetings**
Agricultural energy. Vol. 1. Solar energy livestock production, 6:21878
**SOLAR THERMAL POWER PLANTS**
*See also TOWER FOCUS POWER PLANTS*
**Total Energy Systems**
Total energy systems design, 6:21840
**SOLAR THERMAL RECEIVERS**
*See SOLAR RECEIVERS*
**SOLAR TRACKING**
**Equipment**
Tracking instrument and control for solar concentrators. Final technical report, October 1979-January 1981, 6:21941 (DOE/ET/21109—T1)
**SOLAR WATER HEATERS**
*See also PASSIVE SOLAR WATER HEATERS*
**Cost**
Solar project description for Matt Cannon multi-unit apartment, Gainesville, Florida (Includes glossary), 6:21935 (SOLAR/1044—80/50)
**Design**
Swimming pool heating, 6:21914
**Economic Analysis**
Solar Energy System Economic Evaluation final report for Colt Pueblo, Pueblo, Colorado, 6:21855 (DOE/NASA/CR—161725)
Solar Energy System Economic Evaluation final report for IBM System 4, Clinton, Mississippi, 6:21856 (DOE/NASA/CR—161726)
Solar energy system economic evaluation. Final report for IBM system 3, Glendo, Wyoming, 6:21857 (DOE/NASA/CR—161728)
**Economics**
Economics of solar energy systems: short term costing, 6:21749
**Energy Analysis**
Energy-resource requirements of a solar-heating system, 6:21865 (NP—1902600)
**Marketing Research**
Diffusion of solar energy technologies in the new-construction market: a survey of new solar-home and onventional-home buyers, 6:21853 (DOE/EIA/10189—T2)
**Materials**
Energy-resource requirements of a solar-heating system, 6:21865 (NP—1902600)
**Performance**
Hourly use profiles for solar domestic hot water heaters in the National Solar Data Network, 6:21871 (SOLAR/0005—81/80)
Long-term performance trends for ten solar systems monitored by the national solar data network, 6:21869 (SOLAR/0005—81/80)
National solar data program performance results, Volume II, 6:21866 (SOLAR/0005—81/80)
Performance of solar energy hot water systems, 6:21868 (SOLAR/0005—81/80)
Saddle Hill Trust Lot 73, Medway, Massachusetts: solar energy system performance evaluation, January 1980-December 1980, 6:21875 (SOLAR/1039—81/14)
Solar energy system performance evaluation, October 1979-April 1980: Bond Construction, Gladstone, Missouri, 6:21876 (SOLAR/1050—81/14)
**SOLAR WATER HEATING**
**Economic Analysis**
Economics of electric utility backup for solar heating and hot water, 6:21748
**SOLAR-ASSISTED HEAT PUMPS**
**Combined Collectors**
Hybrid photovoltaic/thermal systems with a solar-assisted heat pump, 6:21826
**Design**
Design and field testing of solar-assisted earth coils. Final report, August 1, 1978-January 31, 1981, 6:21847 (DOE/CS/30210—T1)
**Field Tests**
Design and field testing of solar-assisted earth coils. Final report, August 1, 1978-January 31, 1981, 6:21847 (DOE/CS/30210—T1)
**Installation**
Solar-assisted heat pump field performance evaluation. Final report, 6:21859 (DOE/SF/10549—T1)
**Performance**
Second generation ground coupled solar assisted heat pump systems. Six month progress report, 6:21848 (DOE/CS/30224—T1)
Solar-assisted heat pump field performance evaluation. Final report, 6:21859 (DOE/SF/10549—T1)
**SOL-GEL PROCESS**
Sol-gel technology applied to alternative high-level waste forms development, 6:21660 (CONF-8005107—)
**SOLID CLUSTERS**
**Synthesis**
Laser production of supersonic metal cluster beams, 6:22280
**SOLID ELECTROLYTES**
**Failures**
Failure modes of Na-beta alumina (Solid electrolytes in sodium-sulfur batteries), 6:22091 (LBL—12445)
**SOLID STATE LASERS**
**Reviews**
Lanthanide and actinide lasers, 6:22377
**SOLID WASTES**
*See also AGRICULTURAL WASTES*
*MINERAL WASTES*
*WOOD WASTES*
**Leaching**
Coal conversion solid wastes: characterization for environmental assessment, 6:21515 (ORNL/TM—7533)
**Recycling**
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)
**Waste Product Utilization**
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, December 1980-February 1981, 6:22240 (DOE/ET/10415—T3)
**SOLIDS**
**Chemical Reactions**
Chemical information from Auger electron spectroscopy, 6:22348
**Computerized Simulation**
MAZE: an input generator for DYNA2D and NIKE2D, 6:22265 (UCID—19029)
**SOLID-STATE PLASMA**
**Wave Propagation**
Electromagnetic waves in a half-space plasma, 6:22864 (ORNL-tr—4750)
**SOLUTIONS**
*(For mathematical solutions see ANALYTICAL SOLUTION or NUMERICAL SOLUTION.)*
*See also LEACHATES*
*PROCESS SOLUTIONS*
**Fluorescence**
Departures from the Stern—Volmer law for fluorescence quenching in liquids, 6:22813
**SOLVENT-REFINED COAL**
**Chemical Bonds**
Quantitation of the reductive cleavage of aryl ethers of SRC and coals. Semi Annual report, September 1980-March 1981, 6:21507 (DOE/PC/30227—T1)
**SOLVENT-REFINING COAL PLANTS**
*See SRC PROCESS*
**SONIC LOGGING**
**Data Analysis**
Acoustic radiation patterns for borehole sources, 6:21961 (LA-UR—81-1092)

**SOOT**
**Air Pollution Abatement**
Soot reduction in diesel engines: a chemical approach, 6:22260
**SOUTH AMERICA**
**Geothermal Resources**
Geothermal resource base of the world: a revision of the Electric Power Research Institute's estimate, 6:21956 (LA—8801-MS)
**SOUTH CAROLINA**
**Peat**
Peat resources of South Carolina, 6:21550
**SOUTH DAKOTA**
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**SPACE HEATING**
**Energy Consumption**
Progress in residential energy conservation: a multi country perspective, 6:22206 (LBL—11701)
**Energy Demand**
Preliminary market analysis for customer side of the meter thermal-energy storage, 6:22193 (DOE/ET/26716—T1)
**Feasibility Studies**
Wind energy for agricultural heating, 6:21990
**SPACE HVAC SYSTEMS**
**Energy Efficiency**
Energy conservation opportunities, 6:22174 (CONF-8003114—)
**Heat Recovery Equipment**
Kathabar runaround energy recovery systems, 6:22235 (CONF-8003114—)
**Heat Storage**
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)
**Maintenance**
Energy conservation opportunities, 6:22174 (CONF-8003114—)
**Operation**
Energy conservation opportunities, 6:22174 (CONF-8003114—)
**SPACE LATTICES**
*See CRYSTAL LATTICES*
**SPACE POWER REACTORS**
**Heat Pipes**
Evaluation of molybdenum and its alloys, 6:22273 (LA-UR—81-1400)
Space power advanced reactor (SPAR), 6:22044 (LA—8797-PR)
**Reactor Kinetics**
Space power advanced reactor (SPAR), 6:22044 (LA—8797-PR)
**Research Programs**
Space power advanced reactor (SPAR), 6:22044 (LA—8797-PR)
**SPACE PROPULSION REACTORS**
**Heat Pipes**
Evaluation of molybdenum and its alloys, 6:22273 (LA-UR—81-1400)
**SPACE VEHICLES**
**Magnetic Refrigerators**
Magnetic refrigeration for spacecraft systems, 6:22421 (LA-UR—81-1084)
**SPACECRAFT POWER SUPPLIES**
**Thermoelectric Generators**
Silicon germanium (SiGe) radioisotope thermoelectric generator (RTG) program for space missions. Nineteenth technical progress report, December 1980-January 1981, 6:22153 (DOE/ET/32043—T7)
**SPARK GAPS**
**Trigger Circuits**
Subnanosecond trigger system for ETA, 6:22457 (UCRL—83992)
**SPEAR**
*(2.5-GeV electron--positron storage ring at SLAC. Stanford University.)*
**Beam Optics**
Computer simulation of longitudinal single-bunch effects in electron-positron storage rings, 6:22476 (SLAC-PUB—2688)
**SPECTRALLY SELECTIVE SURFACES**
**Reviews**
Toward efficiency at the interface: spectrally selective surfaces for photothermal conversion, 6:21952
**SPENT FUEL ELEMENTS**
**Destructive Testing**
Data summary report for the destructive examination of Rods G7, G9, J8, I9, and H6 from Turkey Point Fuel Assembly B17, 6:22027 (HEDL-TME—80-85)
**SPENT FUEL STORAGE**
*See also AWAY-FROM-REACTOR STORAGE*
**Charges**
Discount rate in the spent fuel storage and disposal fee, 6:21649 (ONWI—189)
**Forecasting**
Commercial US nuclear reactors and waste: the status, December 1980, 6:21682 (PNL-SA—9231)
**Temperature Distribution**
Spent fuel dry storage technology development: thermal evaluation of isolated drywells containing spent fuel (1 kW PWR spent fuel assembly), 6:21648 (DOE/NV/00597—5)
**SPENT FUELS**
**Land Transport**
Logistics characterization for regional spent fuel repositories concept, 6:21677 (ONWI—124)
**Leaching**
Probable leaching mechanisms for spent fuel, 6:21644 (CONF-8005107—)
**Nondestructive Analysis**
Inspector-instrument interface in portable NDA instrumentation, 6:21695 (LA-UR—81-1402)
**Nuclear Reaction Analysis**
System for nondestructive assay of spent fuel subassemblies--comparison of calcuations and measurements, 6:21646
**Quantitative Chemical Analysis**
Analysis of plutonium and uranium by the resin bead-mass spectrometric method, 6:22358
**Radiometric Analysis**
New developments in nondestructive measurement and verification of irradiated lwr fuels, 6:21716
**Rail Transport**
Logistics characterization for regional spent fuel repositories concept, 6:21677 (ONWI—124)
**SPENT SHALES**
**Leaching**
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
Multistage leaching of spent modified in situ oil shale retorts, 6:21609 (LA—8744-MS)
**Mineralogy**
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
**SPERMATOZOA**
**Ultrastructural Changes**
Initial stages of sperm penetration into the egg of Fundulus heteroclitus, 6:22657
**SPHEROMAK DEVICES**
**Electric Conductivity**
Simulation of the formation of the PS-1 spheromak, 6:22898
**Implosions**
Simulation of the formation of the PS-1 spheromak, 6:22898
**Impurities**
Simulation of the formation of the PS-1 spheromak, 6:22898
**Plasma Simulation**
Simulation of the formation of the PS-1 spheromak, 6:22898
**Research Programs**
CTR plasma engineering studies. Annual progress report, 1 October 1980-30 September 1981, 6:22878 (DOE/ET/52040—T2)
**SPRAYS**
**Laser Spectroscopy**
Experimental investigation into the application of spontaneous Raman scattering to spray measurements in an engine, 6:22259 (SAND—81-8642)

**SPUTTER-ION PUMPS**
**Penning Discharges**
Pumping behavior of sputter ion pumps, 6:22453
**SQUALANE**
**Phase Studies**
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576
**SRC PROCESS**
**Chemical Reactors**
Gas/slurry flow in coal-liquefaction processes (fluid dynamics in 3-phase flow columns). Quarterly technical progress report, 1 July 1980-30 September 1980, 6:21498 (DOE/ET/14801—12)
**Dissolvers**
Hydrodynamics of coal-liquefaction dissolver configurations, 6:21514 (ORNL/MIT—326)
**SRC-II PROCESS**
**Commercialization**
Commercial scale development of the SRC-II process, 6:21525
**Process Heat**
HTGR-process steam/cogeneration and HTGR-steam cycle program. Semiannual report, April 1, 1980-September 30, 1980, 6:22049 (GA-A—16239)
**SRI LANKA**
**Energy Conservation**
Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))
**Energy Consumption**
Opportunities for energy conservation in the developing countries, 6:22167 (ORAU/IEA—81-1(M))
**STAINLESS STEEL-304**
**Degassing**
Gas release studies from explosion-cladded materials, 6:22922
**Fatigue**
Mechanistic model for time-dependent fatigue, 6:22276
**STAINLESS STEEL-304L**
**Fatigue**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)
**Fracture Properties**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)
**Laser Welding**
Evaluation of laser welding techniques for hydrogen transmission. Final report, September 1977-November 1979, 6:22269 (DOE/ET/26214—T1)
**STAINLESS STEEL-321**
**Permeability**
Hydrogen permeation characteristics of aluminum-coated and aluminum-modified steels, 6:22952
**STAINLESS STEEL-403**
**Standards**
Martensitic stainless steel (Type 403) forgings (ASME SA-182 with additional requirements), 6:22284 (NE-M—2-6T(4-81)(Rev.))
**STAINLESS STEEL-430**
**Permeability**
Hydrogen permeation characteristics of aluminum-coated and aluminum-modified steels, 6:22952
**STAINLESS STEELS**
*See also STAINLESS STEEL-304*
*STAINLESS STEEL-304L*
*STAINLESS STEEL-321*
*STAINLESS STEEL-403*
*STAINLESS STEEL-430*
**Corrosion**
Evaluation of boiler-tube materials for advanced power cycles, 6:21991 (CONF-790145—4)
**Corrosion Resistance**
Evaluation of alloys for fuel cell heat exchangers. Final report (Texaco entrained gasifier), 6:21511 (EPRI-EM—1815)
**Embrittlement**
Hydrogen in titanium alloys, 6:22270 (DOE/ET/52039—2)
**Mechanical Properties**
Hydrogen in titanium alloys, 6:22270 (DOE/ET/52039—2)
**Permeability**
Hydrogen in titanium alloys, 6:22270 (DOE/ET/52039—2)
**Sulfidation**
Evaluation of alloys for fuel cell heat exchangers. Final report (Texaco entrained gasifier), 6:21511 (EPRI-EM—1815)
**STANFORD 20-GEV LINAC**
**Alignment**
Final accelerator inter-segment alignment procedure for sectors one and two: fabricating procedure Nos. L-2, A-8, A-11 and O-1. Assembly procedure for assembly of 40 ft segments, 6:22508 (DOE/SF/00515—T1)
**Beam Dynamics**
Mathematical models for the control program of the SLAC linear collider, 6:22472 (SLAC-PUB—2672)
**Beam Injection**
High-current injector for the proposed SLAC linear collider, 6:22501 (SLAC-PUB—2701)
**Beam Optics**
Non-linear optics for the final focus of the single-pass-collider, 6:22474 (SLAC-PUB—2678)
**Colliding Beams**
Non-linear optics for the final focus of the single-pass-collider, 6:22474 (SLAC-PUB—2678)
**Control Systems**
New generation control system at SLAC, 6:22504 (SLAC-PUB—2704)
**On-Line Control Systems**
Mathematical models for the control program of the SLAC linear collider, 6:22472 (SLAC-PUB—2672)
**STANFORD LINEAR ACCELERATOR CENTER**
**Beam Dynamics**
Single bunch beam measurements for the proposed SLAC linear collider, 6:22500 (SLAC-PUB—2698)
**Colliding Beams**
Single bunch beam measurements for the proposed SLAC linear collider, 6:22500 (SLAC-PUB—2698)
**STATISTICAL MECHANICS**
**Computerized Simulation**
Computer simulations of a continuum system of molecules with a hard-core interaction in the grand canonical ensemble, 6:22867
**STATISTICS**
*See also REGRESSION ANALYSIS*
**Meetings**
1979 DOE statistical symposium, 6:21619 (CONF-791016—)
**STEAM GENERATION**
*See also COGENERATION*
**Performance**
Co-generation, 6:22236 (CONF-8003114—)
**STEAM GENERATION PLANTS**
**Data Compilation**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Refuse-Fueled Boilers**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Surveys**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**STEAM GENERATORS**
**Reliability**
Assessment of the use of human factors in the design of fossil-fired steam-generating systems. Final report, 6:22004 (EPRI-CS—1760)
**Standards**
Class 1 nuclear components (supplement to ASME Boiler and Pressure Vessel Code, Section III, Subsections NCA and NB), 6:22045 (NE-E—15-2NB-T(Rev.)(1-81))
**STEAM TURBINES**
**Design**
R and D for improved efficiency small steam turbines. Phase II. Second quarterly technical report, 6:22243 (DOE/ET/15426—4)
**STEELS**
*See also CARBON STEELS*
*STAINLESS STEELS*

**Corrosion**
AR and TD fossil-energy-materials program. Quarterly progress report, October-December 1980, 6:21513 (ORNL/FMP—81/1)
Atmospheric corrosion of batten and enclosure materials for flat-plate solar collectors, 6:21936 (ANL/EES-TM—135)

**STELLARATORS**
*See also L-2 STELLARATOR*
**Transport Theory**
Verification of the classical theory of helical transport in stellarators, 6:22883 (PPPL—1781)

**STOCKS**
*See INVENTORIES*

**STORAGE (SPENT FUEL)**
*See SPENT FUEL STORAGE*

**STOVER**
*See AGRICULTURAL WASTES*

**STOVES**
**Bibliographies**
Solid-fuel cooking stoves: bibliography, 6:22207 (NP—1902593)
**Construction**
Solid-fuel cooking stoves: bibliography, 6:22207 (NP—1902593)
**Design**
Solid-fuel cooking stoves: bibliography, 6:22207 (NP—1902593)
**Solid Fuels**
Solid-fuel cooking stoves: bibliography, 6:22207 (NP—1902593)
**Thermal Insulation**
Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)

**STRATEGIC PETROLEUM RESERVE**
**Research Programs**
Strategic petroleum reserve (SPR) geotechnical program management and program plan issue C, 6:21594 (SAND—80-2871)
**Site Surveys**
Strategic petroleum reserve (SPR) geological site characterization report, Bayou Choctaw Salt Dome. Sections I and II, 6:21595 (SAND—80-7140)

**STRATOSPHERE**
**Ozone**
Effect of temperature feedback and hydrostatic adjustment in a stratospheric model, 6:22548

**STRAW**
**Acid Hydrolysis**
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980 (Autohydrolysis), 6:21729 (SERI/TR—98174-1)
**Anaerobic Digestion**
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980 (Autohydrolysis), 6:21729 (SERI/TR—98174-1)

**STRENGTH (TENSILE)**
*See TENSILE PROPERTIES*

**STRONTIUM**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Partition**
Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D, 6:21687 (UCRL—15347)

**STRONTIUM 87 TARGET**
**Electron Reactions**
Exchange current effects in magnetic electron scattering from $^{49}$Ti, $^{51}$V, $^{59}$Co, $^{87}$Sr, and $^{93}$Nb, 6:22850

**STRONTIUM IONS**
**Emission Spectra**
Spectrum and energy levels of nine-times ionized strontium [Sr X], 6:22347
**Energy Levels**
Spectrum and energy levels of nine-times ionized strontium [Sr X], 6:22347

**STUDS**
*See FASTENERS*

**SUBBITUMINOUS COAL**
**Ashes**
Low-rank coal study : national needs for resource development. Volume 2. Resource characterization, 6:21543 (DOE/FC/10066—T1(Vol.2))
**Calorific Value**
Low-rank coal study : national needs for resource development. Volume 2. Resource characterization, 6:21543 (DOE/FC/10066—T1(Vol.2))
**Market**
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))

**SUCCINIC ACID**
**Electron Spectra**
Photoelectron spectroscopy of carbonyls: saturated normal dicarboxylic acids, 6:22382

**SUGAR CANE**
**Yields**
Production of sugarcane and tropical grasses as a renewable energy source. Third quarterly report, December 1, 1980-February 28, 1981, 6:21761 (DOE/ET/20071—T4)

**SUGARS**
*See SACCHARIDES*

**SULFATES**
**Chemical Reaction Yield**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Environmental Impacts**
Estimated ambient $SO_2$ and $SO_4$ impacts, 6:22536 (ANL/EES-TM—130)
**Monitoring**
Emissions inventory for the SURE Region. Final report, 6:22545 (EPRI-EA—1913)
**Scrubbing**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Toxicity**
Studies of pollutant aerosol simulants in normal and susceptible human subjects, 6:22716

**SULFITES**
**Chemical Reactions**
Kinetics of the formation of hydroxylamine disulfonate by reaction of nitrite with sulfites, 6:22366

**SULFONATES**
**Chemical Preparation**
Kinetics of the formation of hydroxylamine disulfonate by reaction of nitrite with sulfites, 6:22366

**SULFUR**
**Adsorption**
Chemisorption—corrosion transition: The role of surface impurities as markers for evaluating the transition, 6:22290
**Chemical State**
Determination of relative concentrations of primary and secondary organics and speciation of sulfur compounds by thermal analysis and photoelectron spectroscopy, 6:22546 (LBL—12539)
**Chemisorption**
Chemisorption—corrosion transition: The role of surface impurities as markers for evaluating the transition, 6:22290
**Recovery**
Fundamentals of catalytic and thermal reactions. Catalysis for chemicals and fuels. Chemistry of enhanced oil recovery. Sulfur recovery and utilization, 6:21580
**Spectra**
Combustion diagnostics by tunable atomic line molecular spectroscopy, 6:22364 (LBL—12127)
**Synergism**
Influence of fuel sulfur on the selective reduction of NO by $NH_3$, 6:21596 (LBL—12128)

**SULFUR CARBIDES**
*See CARBON SULFIDES*

**SULFUR DIOXIDE**
**Air Pollution Abatement**
Regional and national $SO_2$ control costs, 6:22464 (ANL/EES-TM—130)

**Air Pollution Control**
State of fluidized bed combustion technology, 6:22462
**Chemical Reaction Yield**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Corrosive Effects**
Chemical durability improvement of glass shells, 6:22947
**Emission**
Regional and national $SO_2$ emissions, 6:21541 (ANL/EES-TM—130)
**Environmental Impacts**
Air quality analysis of Phase I of the proposed oil backout legislation (Lead abstract), 6:21540 (ANL/EES-TM—130)
Air quality analysis of Phase I of the proposed oil backout legislation: Introduction, 6:22229 (ANL/EES-TM—130)
Estimated ambient $SO_2$ and $SO_4$ impacts, 6:22536 (ANL/EES-TM—130)
**Monitoring**
Emissions inventory for the SURE Region. Final report, 6:22545 (EPRI-EA—1913)
**Scrubbing**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Toxicity**
Effects of $SO_2$ dosage kinetics and exposure frequency on photosynthesis and transpiration of kidney beans (Phaseolus vulgaris L.), 6:22712

**SULFUR FLUORIDES**
**Dissociation**
Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)
**Energy Levels**
Method for nuclear spin statistics in molecular spectroscopy, 6:22796
**Excitation**
Laser excitation of $SF_6$ in a transparent nozzle beam: collision-assisted absorption and up-pumping, 6:22397
**Photon-Molecule Collisions**
Multiphoton dissociation and thermal unimolecular reactions induced by infrared lasers, 6:22786 (LBL—12626)
**Stimulated Emission**
Self-focusing in $SF_6$, 6:22775 (LA-UR—81-1157)

**SULFUR HYDRIDES**
*See HYDROGEN SULFIDES*

**SULFUR IONS**
**Energy-Level Transitions**
Recent results in $\Delta n = 0$, $n = 2$ transitions of helium-like systems, 6:22765 (ANL—80-126)
**Lamb Shift**
Precision determinations of high Z hydrogenic ion Lamb shifts, 6:22761 (ANL—80-126)

**SULFURIC ACID**
**Chemical Reaction Yield**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)
**Scrubbing**
Measurement of sulfate aerosols from western low-rank-coal-fired boilers with FGD: results of tests at clay Boswell Unit 4, 6:22008 (DOE/FC/10182—T12)

**SUPERCONDUCTING CABLES**
**Surges**
Wave propagation in a dc superconducting cable--1. Analysis, 6:22014
**Wave Propagation**
Wave propagation in a dc superconducting cable--1. Analysis, 6:22014

**SUPERCONDUCTING CAVITY RESONATORS**
**Modulation**
Superconducting cavities and modulated RF, 6:22496 (SLAC-PUB—2682)

**SUPERCONDUCTING MAGNETS**
*See also MAGNETIC ENERGY STORAGE*
Some aspects of the study of gas-discharge plasma and production of high magnetic fields (Book), 6:22152 (DOE-tr—73)
**Design**
Cryogenic system for the mirror fusion test facility, 6:22954
Force and inductance calculations for pulsed energy storage shielded magnets, 6:22085
**Uses**
Superconducting magnetic energy storage applications and benefits for electric utility power systems, 6:22086

**SUPERCONDUCTORS**
**Voltage Drop**
Time-dependent voltage generated by flux motion across a superconducting strip, 6:22865

**SUPERCRITICAL FLOW**
*See TURBULENT FLOW*

**SUPERGRAVITY**
**Unified Gauge Models**
Grand unification in $N = 8$ extended supergravity, 6:22833

**SUPERHILAC**
**Beam Injection**
New, rugged, high power Cockcroft-Walton power supply, 6:22489 (LBL—11715)
**Research Programs**
Nuclear science. Annual report, July 1, 1979-June 30, 1980, 6:22844 (LBL—11588)
**RF Systems**
Simplified RF power system for Wideroe-type linacs, 6:22488 (LBL—11713)

**SUPERNOVAE**
**Cosmic Radiation**
Galactic origin of cosmic rays I, 6:22739 (LA-UR—81-965)

**SURFACE FINISHING**
*See also ETCHING*
**Infusion**
Polymeric mandrels: supersmooth finish by an infusion process, 6:22309

**SURFACE MINING**
*See also COAL MINING*
*OIL SHALE MINING*
**Environmental Impact Statements**
Final environmental impact statement. Green River-Hams Fork regional coal, 6:22598
**Environmental Impacts**
DOE peat program, 6:21521
**Feasibility Studies**
DOE peat program, 6:21521
**Land Reclamation**
Environmental issues and strategies for peat energy development in the US, 6:21565
Peatland reclamation - the energy crop option, 6:21553
**Land Use**
Environmental issues and strategies for peat energy development in the US, 6:21565
**Research Programs**
The US Department of Energy's coal mining research, 6:21554
**Socio-Economic Factors**
DOE peat program, 6:21521

**SURFACE PROPERTIES**
**Equations**
Scheme for computing surface fluxes from mean flow observations, 6:22534

**SURFACE WATERS**
*See also ESTUARIES*
*RIVERS*
**Radiation Monitoring**
Uranium in US surface, ground, and domestic waters, 6:22597 (EPA—570/9-81-001(Vol.1))

**SURFACE-ACTIVE AGENTS**
*See SURFACTANTS*

**SURFACTANTS**
**Absorption Spectra**
Monolayer films of surfactant derivatives of methylene blue, 6:21808
**Adsorption**
Adsorption from selected microemulsions onto alumina (Surfactant is sodium laurate; cosurfactant is n-hexanol), 6:21579

**Precipitation**
Salting-out and multivalent cation precipitation of anionic surfactants, 6:21578
**Solar Energy Conversion**
Monolayer films of surfactant derivatives of methylene blue, 6:21808
**SURRY POWER STATION UNIT-1**
*See SURRY-1 REACTOR*
**SURRY-1 REACTOR**
**Reactor Maintenance**
Final environmental impact statement. Surry Power Station, Unit No. 1 steam generator repair, Virginia Electric and Power Company, 6:22604
**SURVIVAL CURVES**
**Statistical Models**
Proceedings of the 1980 DOE statistical symposium (Lead Abstract), 6:22538 (CONF-801045—)
**SWIMMING POOLS**
**Solar Water Heating**
Swimming pool heating, 6:21914
**SYNROC**
*See SYNTHETIC ROCKS*
**SYNROC PROCESS**
Application of SYNROC to high-level defense wastes, 6:21654 (CONF-8005107—)
Technical support, 6:22333 (ORNL—5738)
**SYNTHANE PROCESS**
**Pilot Plants**
Synthane process update, mid-'78, 6:21529
**SYNTHESIS GAS**
**Chemical Reactions**
Synopsis of interim final report. conceptual design of a coal-to-methanol commercial plant, 6:21733
**SYNTHETASES**
*See LIGASES*
**SYNTHETIC FUELS**
*See also ALCOHOL FUELS*
*HYDROGEN FUELS*
*SYNTHETIC PETROLEUM*
**Chemical Analysis**
Bio/organic analysis section, 6:22334 (ORNL—5738)
**SYNTHETIC MATERIALS**
*See also PLASTICS*
*SYNTHETIC ROCKS*
**Impurities**
Application of EPR spectroscopy to the characterization of crystalline nuclear waste forms, 6:21657 (CONF-8005107—)
**SYNTHETIC PETROLEUM**
**Phase Studies**
Liquid-liquid phase behavior in $CO_2$-hydrocarbon systems, 6:21576
**SYNTHETIC ROCKS**
**Chemical Radiation Effects**
Radiation damage in natural materials: implications for radioactive waste forms, 6:21655 (CONF-8005107—)
**Mineralogy**
Application of SYNROC to high-level defense wastes, 6:21654 (CONF-8005107—)
**Physical Radiation Effects**
Radiation damage in natural materials: implications for radioactive waste forms, 6:21655 (CONF-8005107—)
**SYSTEMS ANALYSIS**
**Computer Codes**
Linear system analysis program: programmer's manual, 6:22979 (UCID—30183)

## T

**TANDEM ACCELERATORS**
*See VAN DE GRAAFF ACCELERATORS*
**TANDEM ELECTROSTATIC ACCELERATORS**
**Breakdown**
Investigation of periodic acceleration tube discharges with a capacitive pickup array, 6:22466 (DOE/ER/01388—488)
**TANTALUM**
**Collisions**
Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**Electron Beams**
Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**Far Ultraviolet Radiation**
Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**Soft X Radiation**
Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**TANTALUM ALLOYS**
**Thermodynamic Properties**
Combined thermodynamic study of nickel-base alloys. Progress report, 6:22271 (DOE/OR/05951—T1)
**TAR SANDS**
*See OIL SANDS*
**TARGET CHAMBERS**
**Design**
Charge transfer to the continuum by heavy ions in atomic hydrogen, 6:22769 (CONF-810432—3)
**TARGETS**
*See also BERYLLIUM 9 TARGET*
*CARBON 12 TARGET*
*COBALT 59 TARGET*
*HELIUM 3 TARGET*
*LASER TARGETS*
*LITHIUM 6 TARGET*
*NEON 20 TARGET*
*NIOBIUM 93 TARGET*
*POLARIZED TARGETS*
*STRONTIUM 87 TARGET*
*TITANIUM 49 TARGET*
*URANIUM 238 TARGET*
*VANADIUM 51 TARGET*
**Ablation**
Stationary flow model of ablatively imploded spherical shells, 6:22907 (DOE/DP/40003—T1)
**Fabrication**
Metallic coating of microspheres, 6:22937
Polymer shells by the droplet method, 6:22942
**Inertial Confinement**
"Vacuum" layer double-shell cryogenic inertial fusion targets, 6:22943
**Interferometry**
Interferometric measurements of multilayer and double-shell inertial fusion targets, 6:22935
**Microscopy**
Acoustic microscopy for ICF target analysis, 6:22940
**Optical Microscopy**
Interferometric measurements of multilayer and double-shell inertial fusion targets, 6:22935
**Refractivity**
Interferometric measurements of multilayer and double-shell inertial fusion targets, 6:22935
**Structural Models**
"Vacuum" layer double-shell cryogenic inertial fusion targets, 6:22943
**Thickness**
Interferometric measurements of multilayer and double-shell inertial fusion targets, 6:22935
**TATB**
*(1,3,5-Triamino-2,4,6-trinitrobenzene.)*
**Production**
Manufacture of triaminotrinitrobenzene, 6:22522 (LA-UR—81-992)
**TECHNETIUM SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581
**TEFLON**
**Comparative Evaluations**
Upgrading high-nitrogen natural gas by selective membrane permeation, 6:21600
**TELLURIUM**
**Collisions**
Interactions of molecules with surfaces. Progress report, 1 May 1980-31 March 1981, 6:22772 (DOE/ER/04974—T1)

**TEMPERATURE (AMBIENT)**
*See AMBIENT TEMPERATURE*
**TENDONS (STRUCTURAL)**
*See CABLES*
**TENNESSEE VALLEY AUTHORITY**
**Financial Data**
Power Program Summary. Volume II. Fiscal year ending June 30, 1980, 6:22138 (TVA/OP/PINF—81/2)
**TENSILE PROPERTIES**
**Testing**
Tensile testing of glass microshells, 6:22950
**TERBIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**TERBIUM PHOSPHATES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**TERBIUM SULFIDES**
**Antiferromagnetism**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Ferromagnetism**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Magnetization**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Neutron Diffraction**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Superconductivity**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**Transition Temperature**
Magnetic order in superconducting $TbMo_6S_8$, $DyMo_6S_8$, and $ErMo_6S_8$, 6:22317
**TERRESTRIAL ECOSYSTEMS**
**Evaluation**
Terrestrial sources of organic carbon, 6:22554 (CONF-8009140—)
**TEST FACILITIES**
**Data Acquisition Systems**
Reliability studies of materials using several LSI-11 based systems, 6:22448 (UCRL—85254)
**Design**
150mm launcher facility for shockwave compression experiments: a critical review and conceptual design study, 6:22527 (UCRL—15334)
Reliability studies of materials using several LSI-11 based systems, 6:22448 (UCRL—85254)
**Operation**
150mm launcher facility for shockwave compression experiments: a critical review and conceptual design study, 6:22527 (UCRL—15334)
**Research Programs**
EG and G support to LLNL, 1 January 1981-31 March 1981, 6:22528 (EGG—1183-4221)
**Risk Assessment**
Safety analysis of the 700-horsepower combustion test facility, 6:21561 (DOE/PC/30198—T4)
**Safety Engineering**
Safety analysis of the 700-horsepower combustion test facility, 6:21561 (DOE/PC/30198—T4)
**TESTES**
**Biological Radiation Effects**
Radiation effects on brain weight and gonad weight in Segment II beagles, 6:22689 (FDA—81-8042)
Testicular atrophy and neoplasia in Segment III beagles sacrificed at 5 and 8 years of age, 6:22686 (FDA—81-8042)
**Pathological Changes**
Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age, 6:22677 (FDA—81-8042)
**TEXAS**
**Geochemical Surveys**
Methods development and applications evaluations of NURE aerial reconnaissance survey data for uranium resource evaluation: Beeville/Bay City and Crystal City quadrangles, Texas, 6:21621 (GJBX—69(81))
**Geologic Structures**
Structure of the Presidio Bolson area, Texas, interpreted from gravity data, 6:21959 (DOE/ET/28388—T1)
**Geopressured Systems**
Operations research and systems analysis of geopressured/geothermal resources in Texas. Final report, 6:21966 (DOE/ET/27087—T1)
**Geothermal Resources**
Operations research and systems analysis of geopressured/geothermal resources in Texas. Final report, 6:21966 (DOE/ET/27087—T1)
**Gravity Surveys**
Structure of the Presidio Bolson area, Texas, interpreted from gravity data, 6:21959 (DOE/ET/28388—T1)
**Radiometric Surveys**
Methods development and applications evaluations of NURE aerial reconnaissance survey data for uranium resource evaluation: Beeville/Bay City and Crystal City quadrangles, Texas, 6:21621 (GJBX—69(81))
**Wind Power**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
**TFTR REACTORS**
**Calorimeters**
Fusion energy calorimeter for the tokamak fusion test reactor, 6:22885 (PPPL—1791)
**Limiters**
Material selection for TFTR limiters, 6:22921
**Vacuum Pumps**
Effect of hydrogen glow discharge conditioning on Zr/Al getter pumps, 6:22929
**THERMAL COMFORT**
**Measuring Methods**
Index to quantify thermal comfort in homes, 6:22217
**THERMAL CONDUCTION**
*(Heat transfer by conduction.)*
**Mathematical Models**
Finite element model for heat conduction in jointed rock masses, 6:21684 (SAND—80-2016)
**THERMAL ENERGY STORAGE EQUIPMENT**
Status and prospects of local solar heating and cooling systems, 6:21933
**Economics**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)
**Feasibility Studies**
Domain of applicability for HTGR molten salt energy transport and storage system, 6:22048 (DOE/SF/02034—T14)
**Marketing Research**
Preliminary market analysis for customer side of the meter thermal-energy storage, 6:22193 (DOE/ET/26716—T1)
**Off-Peak Energy Storage**
Technical and financial aspects of electric utility peak load reduction through solar space heating system controls, 6:21931
**Performance**
Thermal energy storage for building heating and cooling and industrial applications. Technical progress report, March 1980-February 1981, 6:22088 (ORNL/TM—7779)
**THERMAL INSULATION**
**Economic Analysis**
Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)

**Energy Efficiency**
Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)
**Information**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
**Payback Period**
Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)
**Performance**
Improving economic performance through insulation retrofit and the use of economic insulation thicknesses, 6:22177 (CONF-8003114—)
**Thickness**
Improving economic performance through insulation retrofit and the use of economic insulation thicknesses, 6:22177 (CONF-8003114—)
**Uses**
High temperature thermal insulation usage in UK process industries, 6:22245 (NP—1902598)

**THERMAL NEUTRONS**
**Neutron Reactions**
New aspects in the evaluation of thermal neutron cross sections, 6:22858 (BNL-NCS—29035)

**THERMAL POWER PLANTS**
*See also COMBINED-CYCLE POWER PLANTS*
*FOSSIL-FUEL POWER PLANTS*
*GEOTHERMAL POWER PLANTS*
*NUCLEAR POWER PLANTS*
*REFUSE-FUELED POWER PLANTS*
**Cooling Systems**
Optimizing power plant coolant systems, 6:21993 (CONF-8003114—)
**Fluidized-Bed Combustors**
Development support by ORNL for TVA AFBC Pilot Plant, 6:21992 (CONF-810567—1)

**THERMIONIC CONVERTERS**
**Fabrication**
Application of microfabrication technology to thermionic energy conversion. Progress report No. 6, November 1, 1980-January 31, 1981, 6:22156 (DOE/ET/15423—6)
Application of microfabrication technology to thermionic energy conversion. Progress report No. 5, August 1, 1980-October 31, 1980, 6:22155 (DOE/ET/15423—5)
**Microelectronics**
Application of microfabrication technology to thermionic energy conversion. Progress report No. 6, November 1, 1980-January 31, 1981, 6:22156 (DOE/ET/15423—6)
Application of microfabrication technology to thermionic energy conversion. Progress report No. 5, August 1, 1980-October 31, 1980, 6:22155 (DOE/ET/15423—5)
**Research Programs**
Advanced thermionic energy conversion. Joint highlights and status report, July-September 1979, 6:22154 (DOE/ET/11293—T3)

**THERMOELECTRIC CONVERSION**
**Research Programs**
Ocean energy conversion systems annual research report, 6:21843 (SERI/TR—634-1011)

**THERMOELECTRIC GENERATORS**
**Radioisotope Heat Sources**
Silicon germanium (SiGe) radioisotope thermoelectric generator (RTG) program for space missions. Nineteenth technical progress report, December 1980-January 1981, 6:22153 (DOE/ET/32043—T7)
**Research Programs**
Silicon germanium (SiGe) radioisotope thermoelectric generator (RTG) program for space missions. Nineteenth technical progress report, December 1980-January 1981, 6:22153 (DOE/ET/32043—T7)

**THERMOLUMINESCENT DOSEMETERS**
**Calibration**
Calibration of personnel radiation measurement instruments, 6:22510 (CONF-801045—)

**THERMONUCLEAR POWER PLANTS**
**Comparative Evaluations**
Assessment of a satellite power system and six alternative technologies, 6:21811 (DOE/ER—0099)
**Research Programs**
Advanced Power Systems Division (Report section), 6:22136 (EPRI-P—1726-SR)

**THERMONUCLEAR REACTIONS**
**Plasma Diagnostics**
Impurity studies in fusion devices using laser-fluorescence spectroscopy, 6:22902

**THERMONUCLEAR REACTORS**
*(For use in cases where certain aspects of either hypothetical or real thermonuclear reactors are discussed.)*
*See also DOUBLET REACTORS*
*I-BEAM TYPE REACTORS*
*LASER FUSION REACTORS*
*TFTR REACTORS*
*TMR REACTORS*
*TOKAMAK TYPE REACTORS*
**Electric Motors**
High response control of stator watts and vars for large wound rotor induction motor adjustable speed drives, 6:22962
**Ion Beams**
Nonevaporable getter for ion beam fusion, 6:22930

**THERMONUCLEAR WEAPONS**
*See NUCLEAR WEAPONS*

**THIO COMPOUNDS**
*See ORGANIC SULFUR COMPOUNDS*

**THORIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Solvent Extraction**
Thermodynamics of extraction of U(VI) and Th(IV) from nitric acid by neutral phosphorus-based organic compounds, 6:22349

**THORIUM 230**
**Environmental Transport**
Preliminary study of the transport and distribution of radium, radon and their alpha-emitting daughters using nuclear emulsions and polonium-210. Final report, 6:21640 (GJBX—144(81))

**THORIUM OXIDES**
**Thermodynamic Properties**
Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species, 6:22410
Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species, 6:21645

**THREE MILE ISLAND-2 REACTOR**
**Nuclear Materials Management**
Accountability study for TMI-2 fuel, 6:22026 (GEND—016)
**Radioactivity**
Containment description and radionuclear status, 6:22075 (GEND—002)
**Reactor Accidents**
Three Mile Island Unit-2 core status summary: a basis for tool development for reactor disassembly and defueling, 6:22076 (GEND—007)

**THYMIDINE**
**Radiation Chemistry**
ESR study of DNA base cation radicals produced by attack of oxidizing radicals, 6:22405

**THYMINE**
**Radiation Chemistry**
ESR study of DNA base cation radicals produced by attack of oxidizing radicals, 6:22405

**THYROID**
**Biological Radiation Effects**
Atrophic thyroiditis in long-term Segment III beagles, 6:22679 (FDA—81-8042)
Thyroid neoplasia in long-term Segment III beagles, 6:22680 (FDA—81-8042)

**Neoplasms**
Case report: study of a beagle with a malignant ectopic thyroid tumor, 6:22692 (FDA—81-8042)
**Pathological Changes**
Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age, 6:22677 (FDA—81-8042)

**THYROIDITIS**
**Radioinduction**
Atrophic thyroiditis in long-term Segment III beagles, 6:22679 (FDA—81-8042)

**TIME-OF-USE PRICING**
**Economic Elasticity**
Correcting for truncation bias in the analysis of experiments in time-of-day pricing of electricity, 6:22139

**TIMING CIRCUITS**
Timer powder-pressing study, 6:22424 (MLM—2826)

**TIN**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)

**TIN COMPOUNDS**
**Chemical Reactions**
Quantitative determination of carboxylic acids and their salts and anhydrides in asphalts by selective chemical reactions and differential infrared spectrometry, 6:22343

**TITANIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Cleaning**
Test results of heat-exchanger cleaning in support of ocean thermal energy conversion, 6:21841 (DOE/CH/00135—3)
**Decomposition**
Thermal decomposition of Ti getter films from the DITE tokamak, 6:22928
**Degassing**
Gas release studies from explosion-cladded materials, 6:22922
**Desorption**
Thermal decomposition of Ti getter films from the DITE tokamak, 6:22928
**Doublet Reactors**
Titanium gettering in Doublet III, 6:22927
**Heat Transfer**
Test results of heat-exchanger cleaning in support of ocean thermal energy conversion, 6:21841 (DOE/CH/00135—3)
**Ion Collisions**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**Physical Radiation Effects**
Deuterium and helium ion irradiation effects on $TiB_2$ coatings, 6:22960
**Pyrolysis**
Thermal decomposition of Ti getter films from the DITE tokamak, 6:22928
**Sputtering**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285

**TITANIUM 49 TARGET**
**Electron Reactions**
Exchange current effects in magnetic electron scattering from $^{49}Ti$, $^{51}V$, $^{59}Co$, $^{87}Sr$, and $^{93}Nb$, 6:22850

**TITANIUM BASE ALLOYS**
**Embrittlement**
Hydrogen in titanium alloys, 6:22270 (DOE/ET/52039—2)
**Mechanical Properties**
Hydrogen in titanium alloys, 6:22270 (DOE/ET/52039—2)
**Permeability**
Hydrogen in titanium alloys, 6:22270 (DOE/ET/52039—2)

**TITANIUM BORIDES**
**Chemical Vapor Deposition**
Mechanical properties of chemical vapor deposited coatings for fusion reactor application, 6:22923
**Mechanical Properties**
Mechanical properties of chemical vapor deposited coatings for fusion reactor application, 6:22923
**Physical Radiation Effects**
Deuterium and helium ion irradiation effects on $TiB_2$ coatings, 6:22960

**TITANIUM CARBIDES**
**Chemical Vapor Deposition**
Mechanical properties of chemical vapor deposited coatings for fusion reactor application, 6:22923
**Mechanical Properties**
Mechanical properties of chemical vapor deposited coatings for fusion reactor application, 6:22923

**TITANIUM OXIDES**
**Ion Collisions**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**Sputtering**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285

**TITANIUM SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581

**TMR REACTORS**
**Breeding Blankets**
Fusion-synfuel tie producing hydrogen with the tandem mirror, 6:21723
**Hydrogen Production**
Fusion-synfuel tie producing hydrogen with the tandem mirror, 6:21723

**TMX DEVICES**
**Research Programs**
Energy and technology review, 6:22920 (UCRL—52000-81-6)
Mirror fusion. Quarterly report, July-September 1980, 6:22887 (UCAR—10060-80-3)

**TNT**
*(Trinitrotoluene.)*
**Detonations**
Project PROPA-GATOR: intermediate range explosion airblast propagation measurements, 6:22526 (SAND—80-1880C)

**TOKAMAK DEVICES**
*See also SPHEROMAK DEVICES*
**Diffusion**
Quasi-linear diffusion and radial transport in tokamaks, 6:22899
**High-Frequency Heating**
Toroidal effects on propagation, damping, and linear mode conversion of lower hybrid waves, 6:22894
**Magnet Coils**
Bow-shaped toroidal field coils, 6:22918 (PPPL—1790)
**Transport Theory**
Quasi-linear diffusion and radial transport in tokamaks, 6:22899

**TOKAMAK ETF**
**Cryopumps**
ETF reactor design status, 6:22925
**Design**
ETF reactor design status, 6:22925
**Divertors**
ETF reactor design status, 6:22925
**Superconducting Magnets**
ETF reactor design status, 6:22925
**Vacuum Systems**
ETF reactor design status, 6:22925

**TOKAMAK TYPE REACTORS**
*See also DOUBLET REACTORS*
*INTOR TOKAMAK*
*TFTR REACTORS*
*TOKAMAK ETF*
**Coatings**
Coatings for fusion reactor environments, 6:22955
Deuterium trapping measurements in aluminum and plasma-sprayed aluminum coatings, 6:22956
Plasma-sprayed coatings for fusion reactor applications, 6:22957
**Magnetic Energy Storage**
Three phase energy transfer circuit with superconducting energy storage coils, 6:22961

**TOMOGRAPHY**
**Images**
Tomographical imaging with limited-angle input, 6:22872
**TOTAL ENERGY SYSTEMS**
**Design**
Total energy systems design, 6:21840
**Solar Energy**
Total energy systems design, 6:21840
**TOTAL-ABSORPTION SPECTROMETERS**
*See SHOWER COUNTERS*
**TOWER FOCUS COLLECTORS**
**Design**
Solar repowering/industrial retrofit system for the Provident Energy Company Refinery. Topical report, September 28, 1979-July 15, 1980, 6:21860 (DOE/SF/10606—T1)
**Economic Analysis**
Solar repowering/industrial retrofit system for the Provident Energy Company Refinery. Topical report, September 28, 1979-July 15, 1980, 6:21860 (DOE/SF/10606—T1)
**TOWER FOCUS POWER PLANTS**
**Combined Cycles**
Preliminary heat pipe testing program. Final technical report, 6:21838 (DOE/SF/10756—1)
**TOXIC MATERIALS**
*See also TOXINS*
**Bioconversion**
Approaches to estimating microbial degradation of chemical contaminants in freshwater ecosystems, 6:22586
Role of biotransformation in environmental hazard assessment, 6:22585
**Biodegradation**
Approaches to estimating microbial degradation of chemical contaminants in freshwater ecosystems, 6:22586
Biotransformation and fate of chemicals in the aquatic environment (Lead abstract), 6:22582
**Biological Accumulation**
Bioavailability of chemicals in aquatic environments, 6:22588
**Environmental Transport**
Environmental toxicology: issues, problems, and challenges, 6:22551
**TOXINS**
**Health Hazards**
Survey of ciguatera at Enewetak and Bikini, Marshall Islands, with notes on the systematics and food habits of ciguatoxic fishes, 6:22573
**TRANSFER (HEAT)**
*See HEAT TRANSFER*
**TRANSFER RNA**
**Ligases**
HeLa cell DNA polymerase α is tightly associated with tryptophanyl-tRNA synthetase and diadenosine 5',5'''-P$^1$,P$^4$-tetraphosphate binding activities, 6:22614
**TRANSFERRIN**
**Electrophoresis**
Electrophoretic variants in three Amerindian tribes: the Baniwa, Kanamari, and central Pano of western Brazil, 6:22640
**TRANSFORMERS**
**Meetings**
Symposium on power and measurement transformers, 6:22009 (CONF-7909201—)
**TRANSMISSION LINES**
*See POWER TRANSMISSION LINES*
**TRANSPIRATION**
**Sensitivity**
Effects of $SO_2$ dosage kinetics and exposure frequency on photosynthesis and transpiration of kidney beans (Phaseolus vulgaris L.), 6:22712
**TRANSPLUTONIUM ELEMENTS**
*See also FERMIUM*
*LAWRENCIUM*
*MENDELEVIUM*
*NOBELIUM*
**Thermodynamic Properties**
Vapor pressure and thermodynamics of actinide metals, 6:22292
**TRANSPORTATION SYSTEMS**
**Demonstration Programs**
Evaluation of the Rochester, New York Community Transit Service Demonstration. Volume I: Executive Summary. Final report, November 1977-March 1980, 6:22228 (UMTA-NY—06-0048-81-1)
**Evaluation**
Evaluation of the Rochester, New York Community Transit Service Demonstration. Volume I: Executive Summary. Final report, November 1977-March 1980, 6:22228 (UMTA-NY—06-0048-81-1)
**Hydrogen Fuels**
Hydrogen-via-Electricity concept. Critique report, 6:21725 (DOE/CE—0005)
**TREES**
*See also PINES*
**Productivity**
Hydrocarbons from plants: analytical methods and observations, 6:21805
**TRIGLYCERIDES**
**Photolysis**
ESR study of electron reactions with esters and triglycerides, 6:22400
**Radiolysis**
ESR study of electron reactions with esters and triglycerides, 6:22400
**TRINEUTRONS**
**Energy Levels**
Resonances in the trineutron-system, 6:22847
**Mass Spectra**
Resonances in the trineutron-system, 6:22847
**TRINITROTOLUENE**
*See TNT*
**TRIPHENYLENE**
**Energy Levels**
Method for nuclear spin statistics in molecular spectroscopy, 6:22796
**TRITIUM**
**Advection**
High-order accurate numerical algorithm for three-dimensional transport prediction, 6:22987
**Desorption**
Thermal decomposition of Ti getter films from the DITE tokamak, 6:22928
**Gettering**
Hydrogen isotope gettering with yttrium metal, 6:22374
**Isotope Effects**
Isotope effects in the lanthanum dihydrides, 6:22368
**Monitoring**
Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)
**Pumping**
Magnetic drive vane pump (Mound drawing No. 18889 and 18890) (12 Mar 1981) (Engineering Materials), 6:22433 (CAPE—2689)
**Radiation Monitoring**
Real-time tritium monitor with an MPC proportional response to airborne mixtures of TH and THO, 6:22515
**Radiation Transport**
High-order accurate numerical algorithm for three-dimensional transport prediction, 6:22987
**X Radiation**
Analysis of x-ray emission and tritium content from glass Microshell inertial fusion targets, 6:22945
**X-Ray Spectra**
Analysis of x-ray emission and tritium content from glass Microshell inertial fusion targets, 6:22945
**TRITIUM COMPOUNDS**
**Autoradiography**
Control of cell proliferation in rabbit lens epithelium, 6:22636
Dependence of herpes simplex virus type 1-induced cell fusion on cell type, 6:22650
**Comparative Evaluations**
Dependence of herpes simplex virus type 1-induced cell fusion on cell type, 6:22650

**TROMBE WALLS**
**Design**
Bridgeview Park facility solar retrofit, 6:21858 (DOE/R5/10216—T1)
**Heat Transfer**
Computer modeling of thermal storage walls, 6:21929
**Performance Testing**
Determination of thermal performance characteristics of modular passive solar storage walls, 6:21904
**Retrofitting**
Bridgeview Park facility solar retrofit, 6:21858 (DOE/R5/10216—T1)
**Thermal Analysis**
Effect of air flow rate in collector-storage walls, 6:21922
**TROPOSPHERE**
**Carbon Dioxide**
Carbon isotopes as indicators of the source and fate of carbon in rivers and estuaries, 6:22562 (CONF-8009140—)
**TUBES**
*(For objects of tubular shape; not for DRIFT TUBES, ELECTRON TUBES or IMAGE STORAGE TUBES.)*
**Sterilization**
Use of microorganisms in enhanced oil recovery, 6:21569 (DOE/BC/10300—10)
**TUFF**
**Field Tests**
Direct observation of a sand-propped hydraulic fracture, 6:21603 (SAND—81-0225)
**Fractures**
Direct observation of a sand-propped hydraulic fracture, 6:21603 (SAND—81-0225)
**Hydraulic Fracturing**
Direct observation of a sand-propped hydraulic fracture, 6:21603 (SAND—81-0225)
**Permeability**
Direct observation of a sand-propped hydraulic fracture, 6:21603 (SAND—81-0225)
**Thermal Conduction**
Finite element model for heat conduction in jointed rock masses, 6:21684 (SAND—80-2016)
**TUMOR CELLS**
**Hybridization**
Dependence of herpes simplex virus type 1-induced cell fusion on cell type, 6:22650
**Molecular Biology**
High-resolution two-dimensional electrophoretic mapping of human proteins, 6:22618
**TUMOR PROMOTERS**
**Biological Effects**
Alterations in polyamine levels induced by phorbol diesters and other agents that promote differentiation in human promyelocytic leukemia cells, 6:22616
**TUMORS**
*See NEOPLASMS*
**TUNGSTEN**
Atom probe analysis of rf-sputtered a-Si:H films, 6:22325
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**Collisions**
Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**Electron Beams**
Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**Far Ultraviolet Radiation**
Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**Soft X Radiation**
Vacuum UV and soft x-ray optical emissions from electron impact on metals, 6:22807
**TUNGSTEN ALLOYS**
**Thermodynamic Properties**
Combined thermodynamic study of nickel-base alloys. Progress report, 6:22271 (DOE/OR/05951—T1)
**TUNGSTEN CARBIDES**
**Erosion**
Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report, 6:21497 (DOE/ET/13537—T3)
**TURBINE BLADES**
**Fracture Properties**
Test evaluation of a laminated wood wind turbine blade concept, 6:21984 (DOE/NASA/20320—30)
**Performance Testing**
Recent Darrieus vertical-axis wind turbine aerodynamical experiments at Sandia National Laboratories, 6:21988 (SAND—81-1108C)
**Stress Analysis**
Test evaluation of a laminated wood wind turbine blade concept, 6:21984 (DOE/NASA/20320—30)
**Stresses**
Accelerometer measurements of aerodynamic torque on the DOE/Sandia 17-m Vertical Axis Wind Turbine, 6:21987 (SAND—80-2776)
**Torque**
Accelerometer measurements of aerodynamic torque on the DOE/Sandia 17-m Vertical Axis Wind Turbine, 6:21987 (SAND—80-2776)
**TURBULENT FLOW**
**Numerical Solution**
Effect of solid particles on the turbulent flow of a round gaseous jet: a mathematical and experimental study. Quarterly technical progress report, January 1-April 30, 1981, 6:22441 (DOE/PC/30303—T2)
**Simulation**
Simulating interactions between turbulence and particles in erosive flow and transport, 6:22443 (UCRL—84691)
**TURKEY POINT-3 REACTOR**
**Spent Fuel Elements**
Data summary report for the destructive examination of Rods G7, G9, J8, I9, and H6 from Turkey Point Fuel Assembly B17, 6:22027 (HEDL-TME—80-85)
**TWO-PHASE FLOW**
**Flow Rate**
Two-phase velocity and density in finite pipes by intrusive and nonintrusive instrumentation, 6:22074 (EGG-M—00881)
**Numerical Solution**
Effect of solid particles on the turbulent flow of a round gaseous jet: a mathematical and experimental study. Quarterly technical progress report, January 1-April 30, 1981, 6:22441 (DOE/PC/30303—T2)
**Simulation**
Simulating interactions between turbulence and particles in erosive flow and transport, 6:22443 (UCRL—84691)
**Three-Dimensional Calculations**
Numerical simulation for two-phase jet problem, 6:22080 (LA-UR—81-317)

## U

**UCLBL**
*See LAWRENCE BERKELEY LABORATORY*
**UCLRL CYCLOTRONS**
**Control Systems**
Use of a small off-line computer in the operation of a versatile heavy ion cyclotron, 6:22487 (LBL—11709)
**U-GAS PROCESS**
Overview of coal-gasification-materials experience in selected pilot plants, 6:21489 (CONF-810417—6)
**Demonstration Plants**
Commercialization of coal gasification, liquefaction, and conversion to electricity, 6:21524
**UHV AC SYSTEMS**
**Potheads**
Evaluation, design, development and delivery of a 1200-kV prototype termination. Ninth technical progress report, December 1, 1980-February 28, 1981, 6:22012 (DOE/ET/29068—T5)

**Power Transmission Towers**
Impedance characteristics of large tower footings to a 100/mu/s wide square wave of current, 6:22016

**ULTRACENTRIFUGE ENRICHMENT PLANTS**
*See CENTRIFUGE ENRICHMENT PLANTS*

**ULTRAVIOLET RADIATION**
**Interactions**
Interactions of radiation and chemical carcinogens, 6:22700
**Measuring Methods**
Actinometric measurement of solar ultraviolet, 6:21742
**Wave Propagation**
Ultraviolet phase conjugation and its practical implications, 6:22435 (LA-UR—81-1565)

**ULTRAVIOLET SPECTROMETERS**
**Lenses**
Ultraviolet-spectrograph lens, 6:22519 (LA-UR—81-1074)

**UNDERGROUND BUILDINGS**
*See EARTH-COVERED BUILDINGS*

**UNDERGROUND MINING**
*See also LONGWALL MINING*
**Research Programs**
The US Department of Energy's coal mining research, 6:21554
**Seismic Surveys**
Applications of reflection seismics to mapping coal-seam structure and discontinuities, 6:21546 (SAND—81-1069C)

**UNH**
**Dehydration**
Technical support, 6:22333 (ORNL—5738)

**UNIFIED GAUGE MODELS**
**Lectures**
Introduction to gauge theories of the strong, weak, and electromagnetic interactions, 6:22824 (FERMILAB-Conf—80/64THY)
**SO Groups**
How unique are SU(5) and SO(10) grand unified theories?, 6:22832
**SU-5 Groups**
How unique are SU(5) and SO(10) grand unified theories?, 6:22832
**SU-8 Groups**
Grand unification in N = 8 extended supergravity, 6:22833

**UNITED KINGDOM**
**Pollution Regulations**
Role of biodegradability in the environmental evaluation of polychlorinated biphenyls and chemicals in general, 6:22600

**UNITED STATES OF AMERICA**
*See USA*

**UNIVAC COMPUTERS**
**Array Processors**
Experience with a multiprocessor based on eight FPS 120B array processors, 6:22974 (LA-UR—81-1082)
**Capacity**
Experience with a multiprocessor based on eight FPS 120B array processors, 6:22974 (LA-UR—81-1082)

**UPSILON RESONANCES**
**Leptonic Decay**
Higher-order JWKB expressions for the energy levels and the wavefunction at the origin, 6:22823 (DOE/ER/03992—423)

**URACIL-6-CARBOXYLIC ACID**
*See OROTIC ACID*

**URACILS**
*See also OROTIC ACID*
*THYMINE*
**Radiation Chemistry**
ESR study of DNA base cation radicals produced by attack of oxidizing radicals, 6:22405

**URANIUM**
*See also ENRICHED URANIUM*
**Absorption Spectra**
Acid-compensated multiwavelength determination of uranium in process streams, 6:22356
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Calcination**
Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry, 6:22340
**Coprecipitation**
Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry, 6:22340
**Exploration**
Principal components analysis as a tool for interpreting NURE aerial radiometric survey data, 6:21642
**Fluorescence Spectroscopy**
Application of a direct method for the determination of trace uranium in safeguards samples by pulsed laser fluorometry, 6:22357
Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry, 6:22340
**Laser Spectroscopy**
Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry, 6:22340
**Marketing Research**
International uranium market, 6:21651 (MIT-EL—80-014)
**Mass Spectroscopy**
Analysis of plutonium and uranium by the resin bead-mass spectrometric method, 6:22358
**Nondestructive Analysis**
In-plant evaluation of a uranium NDA system, 6:22350
**Partition**
Reconnaissance experiments on the possible role of monazite for actinide immobilization in SYNROC-D, 6:21687 (UCRL—15347)
**Photoionization**
Laser induced fluorescence studies of UII produced by photoionization of uranium, 6:22799
**Radioactivity**
Uranium in US surface, ground, and domestic waters, 6:22597 (EPA—570/9-81-001(Vol.1))
**Radioecological Concentration**
Uranium in US surface, ground, and domestic waters. Volume 2, 6:22595 (ORNL/EIS—192/V2)
Uranium in US surface, ground, and domestic waters, 6:22596 (ORNL/EIS—192/V4)
**Solvent Extraction**
Thermodynamics of extraction of U(VI) and Th(IV) from nitric acid by neutral phosphorus-based organic compounds, 6:22349
**Spectrophotometry**
Acid-compensated multiwavelength determination of uranium in process streams, 6:22356
**Titration**
Low level uranium determination by constant current coulometry, 6:22352
**Toxicity**
Mortality among men employed between 1943 and 1947 at a uranium-processing plant, 6:22695
**X-Ray Fluorescence Analysis**
Nondestructive, energy-dispersive, x-ray fluorescence analysis of product stream concentrations from reprocessed nuclear fuels, 6:21647
**X-Ray Spectra**
Evaluation of an l/sub III/ x-ray absorption-edge densitometer for assay of mixed uranium-plutonium solutions, 6:22517

**URANIUM 233**
**Nuclear Reaction Analysis**
Experimental u-233 nondestructive assay with a random driver, 6:22351

**URANIUM 235**
**Laser Isotope Separation**
Photoexcitation system (Dutch patent), 6:21643 (ORNL-tr—4735)
**Nondestructive Analysis**
Inspector-instrument interface in portable NDA instrumentation, 6:21695 (LA-UR—81-1402)

**URANIUM 238 TARGET**
**Neon 20 Reactions**
Nuclear equation of state studied with high-energy heavy ions, 6:22854 (LA-UR—81-1555)

**URANIUM ALLOYS**
**Phase Transformations**
Quantitative x-ray microanalysis of U-Nb alloys with the scanning transmission electron microscope, 6:22278 (SAND—81-0147C)
**X-Ray Radiography**
Quantitative x-ray microanalysis of U-Nb alloys with the scanning transmission electron microscope, 6:22278 (SAND—81-0147C)
**URANIUM ARSENIDES**
**Crystal-Phase Transformations**
Neutron scattering investigation of the phase transitons in uranium arsenide, 6:22318
**Exchange Interactions**
Neutron scattering investigation of the phase transitons in uranium arsenide, 6:22318
**Magnetic Susceptibility**
Neutron scattering investigation of the phase transitons in uranium arsenide, 6:22318
**Neel Temperature**
Neutron scattering investigation of the phase transitons in uranium arsenide, 6:22318
**Neutron Diffraction**
Neutron scattering investigation of the phase transitons in uranium arsenide, 6:22318
**URANIUM CARBIDES**
**Evaporation**
Study of the kinetics of UC vaporization at temperatures above melting point using laser heating technique, 6:22299 (LBL—12548)
**URANIUM COMPLEXES**
**Nuclear Magnetic Resonance**
Nuclear magnetic resonance studies of uranocenes, 6:22411
**URANIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**URANIUM DEPOSITS**
**Aerial Prospecting**
Aerial radiometric and magnetic survey: Grand Junction National Topographic map, Colorado, Utah. Final report, 6:21627 (GJBX—112(81))
Aerial radiometric and magnetic survey: Driggs National Topographic Map, Idaho/Wyoming. Final report, 6:21623 (GJBX—93(81))
Aerial radiometric and magnetic survey: Pullman National Topographic Map, Idaho/Washington. Final report, 6:21628 (GJBX—117(81))
Aerial radiometric and magnetic study: Wallace National Topographic map, Idaho/Montana. Final report, 6:21626 (GJBX—111(81))
Aerial radiometric and magnetic survey; Brushy Basin detail survey: Price/Salina national topographic map sheets, Utah. Volume II. Area I: graphic data. Final report, 6:21620 (GJBX—35((81)(Vol.2)(PriceSalina))
Airborne gamma-ray spectrometer and magnetometer survey, Seattle quadrangle (Washington). Final report, 6:21631 (GJBX—135-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach quadrangle (Washington). Final report, 6:21630 (GJBX—135-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey, Cape Flattery quadrange (Washington). Final report, 6:21633 (GJBX—135-81(Vol.2D))
Airborne gamma-ray spectrometer and magnetometer survey, Wenatchee quadrangle (Washington). Final report, 6:21635 (GJBX—136-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach, Seattle, Cape Flattery, Victoria, Quadrangles (Washington). Final report, 6:21629 (GJBX—135-81(Vol.1))
Airborne gamma-ray spectrometer and magnetometer survey: Wenatchee, Concrete, quadrangles (Washington). Final report, 6:21634 (GJBX—136-81(Vol.1))
Airborne gamma-ray spectrometer and magnetometer survey: Concrete quadrangle (Washington). Final report, 6:21636 (GJBX—136-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey: Victoria quadrangle (Washington). Final report, 6:21632 (GJBX—135-81(Vol.2C))
Methods development and applications evaluations of NURE aerial reconnaissance survey data for uranium resource evaluation: Beeville/Bay City and Crystal City quadrangles, Texas, 6:21621 (GJBX—69(81))
**Prospecting**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Hydrogeochemical and stream sediment reconnaissance basic data for Scottsbluff NTMS Quadrangle, Nebraska and Colorado, 6:21641 (GJBX—145(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
Some concepts of favorability for world-class-type uranium deposits in the northeastern United States, 6:21622 (GJBX—80(81))
**Radiometric Surveys**
Effects of overburden, biomass and atmospheric inversions on energy and angular distributions of gamma rays from U, K, Th, and airborne radon sources. Final report, 6:21639 (GJBX—141(81))
Preliminary study of the transport and distribution of radium, radon and their alpha-emitting daughters using nuclear emulsions and polonium-210. Final report, 6:21640 (GJBX—144(81))
**URANIUM DIOXIDE**
**Atom Transport**
Point defects in uranium dioxide (Oxygen diffusion), 6:22297 (LBL—12548)
**Dehydration**
Release of water vapor from uranium dioxide, 6:22300 (LBL—12548)
**Diffusion**
Tracer surface diffusion on $UO_2$ (1915°C), 6:22302 (LBL—12548)
**Evaporation**
Kinetics of laser pulse vaporization of $UO_2$, 6:22298 (LBL—12548)
**Fission Product Release**
Redistribution of ruthenium in $UO_2$ in a temperature gradient, 6:22301 (LBL—12548)
**Leaching**
Probable leaching mechanisms for spent fuel, 6:21644 (CONF-8005107—)
**Physical Radiation Effects**
Irradiated mixed-oxide-fuel and fission-gas-release behavior during ex-reactor thermal-transient tests, 6:22036 (HEDL-SA—2175)
**Point Defects**
Point defects in uranium dioxide (Oxygen diffusion), 6:22297 (LBL—12548)
**Reduction**
Molecular beam studies of atomic hydrogen reduction of refractory oxides, 6:22275 (LBL—12548)
**URANIUM IONS**
**Fluorescence**
Laser induced fluorescence studies of UII produced by photoionization of uranium, 6:22799
**URANIUM ISOTOPES**
**Mass Spectroscopy**
Quadrupole mass spectrometer for a mobile laboratory to measure isotope ratios, 6:21693 (CONF-810548—3)
**URANIUM MILLS**
*See FEED MATERIALS PLANTS*
**URANIUM OXIDES**
*See also URANIUM DIOXIDE*
**Thermodynamic Properties**
Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species, 6:22410
Relationship between spectroscopic data and thermodynamic functions; application to uranium, plutonium, and thorium oxide vapor species, 6:21645

**URANIUM RESERVES**
**Resource Assessment**
Help, where are we, 6:21618 (CONF-791016—)
**URANYL NITRATES**
**Dehydration**
Technical support, 6:22333 (ORNL—5738)
**URBAN AREAS**
**Appropriate Technology**
Appropriate energy technology for urban areas, 6:22247 (CONF-810565—1)
**Energy Conservation**
Appropriate energy technology for urban areas, 6:22247 (CONF-810565—1)
**Energy Management**
Link between traditional planning and energy management, 6:22112 (CONF-810140—1)
**Transportation Systems**
Analyzing opportunities for energy conservation in municipal fleet management: service delivery patterns, equipment, supply, operations, and maintenance. Information bulletin of the energy task force of the urban consortium, 6:22226 (DOE/IR/05106—T23)
**URINE**
**Biochemistry**
Two-dimensional electrophoresis of human urinary proteins in health and disease, 6:22624
**UROGENITAL SYSTEM DISEASES**
**Radioinduction**
Principal disease or cause of death in nonsacrifice Segment III beagles receiving gamma radiation during development, 6:22676 (FDA—81-8042)
**US DOE**
*See also ENERGY INFORMATION ADMINISTRATION*
*IDAHO CHEMICAL PROCESSING PLANT*
*IDAHO NATIONAL ENGINEERING LABORATORY*
*LAWRENCE BERKELEY LABORATORY*
*ORNL*
*SAVANNAH RIVER PLANT*
*STANFORD LINEAR ACCELERATOR CENTER*
*Y-12 PLANT*
**Administrative Procedures**
Office of the Inspector General. Annual report, 6:22967 (DOE/IG—0008/1)
**Energy Management**
DOE's in-house energy management program, 6:22113 (CONF-8003114—)
Energy management in DOE facilities, 6:22165 (CONF-8003114—)
**Planning**
Environmental issues and strategies for peat energy development in the US, 6:21565
**Program Management**
Office of the Inspector General. Annual report, 6:22967 (DOE/IG—0008/1)
**Research Programs**
DOE peat program, 6:21521
Outlook for in situ gasification of eastern coal, 6:21522
**Wind Power Plants**
Large wind turbines: early operational experience and potential for supplying electricity, 6:21979
**USA**
*(For national information only. See individual states for specific references.)*
*See also APPALACHIA*
*MID-ATLANTIC REGION*
*NORTH ATLANTIC REGION*
*PACIFIC NORTHWEST REGION*
**Air Pollution**
Mobile source emission inventory, 6:22544 (EPA-AA-TEB—81-11)
**Coal Deposits**
Low-rank coal study : national needs for resource development. Volume 2. Resource characterization, 6:21543 (DOE/FC/10066—T1(Vol.2))
**Coal Reserves**
Low-rank coal study : national needs for resource development. Volume 2. Resource characterization, 6:21543 (DOE/FC/10066—T1(Vol.2))
**Coordinated Research Programs**
Coal gettability testing: the evaluation methods and coal gettability checking in strata, 6:21555 (DOE/TIC—1015202)
**Employment**
Effect of OPEC oil pricing on output, prices, and exchange rates in the United States and other industrialized countries, 6:21588
Regional economic and energy consumption implications of the NEP-2 base case scenarios, 6:22121 (ORNL/TM—7199)
**Energy Consumption**
Regional economic and energy consumption implications of the NEP-2 base case scenarios, 6:22121 (ORNL/TM—7199)
**Energy Demand**
Input parameters for LEAP and analysis of the Model 22C data base, 6:22120 (ORNL—5746)
**Energy Supplies**
Input parameters for LEAP and analysis of the Model 22C data base, 6:22120 (ORNL—5746)
**Ground Water**
Uranium in US surface, ground, and domestic waters. Volume 2, 6:22595 (ORNL/EIS—192/V2)
Uranium in US surface, ground, and domestic waters, 6:22596 (ORNL/EIS—192/V4)
**Human Populations**
Deposition and retention of plutonium in the United States general population, 6:22556 (LA-UR—81-1175)
**Inflation**
Effect of OPEC oil pricing on output, prices, and exchange rates in the United States and other industrialized countries, 6:21588
**Insolation**
April 1981 environmental data for sites in the National Solar Data Network, 6:21741 (SOLAR/0010—81/04)
**Irradiation Reactors**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Legislation**
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))
**Mammals**
Marine mammals of the Southeastern United States coast and the Gulf of Mexico, 6:22572 (FWS/OBS—80/41)
**Meteorology**
April 1981 environmental data for sites in the National Solar Data Network, 6:21741 (SOLAR/0010—81/04)
**Peat**
Low-rank coal study: national needs for resource development. Volume 6. Peat, 6:21544 (DOE/FC/10066—T1(Vol.6))
**Petroleum Deposits**
Analysis of cumulative crude oil discovery and production, 6:22127
**Pollution Regulations**
Nitrilotriacetate: hindsight and gunsight, 6:22592
**Population Dynamics**
Regional economic and energy consumption implications of the NEP-2 base case scenarios, 6:22121 (ORNL/TM—7199)
**Power Reactors**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Production Reactors**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Regulations**
Low-rank coal study. Volume 4. Regulatory, environmental, and market analyses, 6:21567 (DOE/FC/10066—T1(Vol.4))
**Research and Test Reactors**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Surface Waters**
Uranium in US surface, ground, and domestic waters. Volume 2, 6:22595 (ORNL/EIS—192/V2)
Uranium in US surface, ground, and domestic waters, 6:22596 (ORNL/EIS—192/V4)

**Wind Power**
Federal Wind Energy Program for wind resource assessment and siting: an overview, 6:21981
**Wind Power Plants**
Federal Wind Energy Program for wind resource assessment and siting: an overview, 6:21981
**Zero Power Reactors**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)

**UTAH**
**Magnetic Surveys**
Aerial radiometric and magnetic survey: Grand Junction National Topographic map, Colorado, Utah. Final report, 6:21627 (GJBX—112(81))
Aerial radiometric and magnetic survey; Brushy Basin detail survey: Price/Salina national topographic map sheets, Utah. Volume II. Area I: graphic data. Final report, 6:21620 (GJBX—35((81)(Vol.2)(PriceSalina))
**Radiometric Surveys**
Aerial radiometric and magnetic survey: Grand Junction National Topographic map, Colorado, Utah. Final report, 6:21627 (GJBX—112(81))
Aerial radiometric and magnetic survey; Brushy Basin detail survey: Price/Salina national topographic map sheets, Utah. Volume II. Area I: graphic data. Final report, 6:21620 (GJBX—35((81)(Vol.2)(PriceSalina))

**UTILITIES**
*See ELECTRIC UTILITIES*
*PUBLIC UTILITIES*

## V

**VACUUM PUMPS**
*See also CRYOPUMPS*
*SPUTTER-ION PUMPS*
**Getters**
Effect of hydrogen glow discharge conditioning on Zr/Al getter pumps, 6:22929

**VACUUM SYSTEMS**
**Cryopumps**
TSTA compound cryopump, 6:22931
**Degassing**
Interrupted pumpdown of a vacuum system, 6:22455
**Low Pressure**
Steam ejector-condenser: stage I of a differential vacuum pumping station, 6:22454
**Pressure Gages**
Water vapor pressure gauge, 6:22451
**Pumping**
Interrupted pumpdown of a vacuum system, 6:22455
**Sputter-Ion Pumps**
Pumping behavior of sputter ion pumps, 6:22453
**Testing**
Evaluation of ISABELLE full cell ultrahigh vacuum system, 6:22507
**Ultrahigh Vacuum**
Evaluation of ISABELLE full cell ultrahigh vacuum system, 6:22507
Pumping behavior of sputter ion pumps, 6:22453
**Valves**
Selection and evaluation of an ultrahigh vacuum gate valve for ISABELLE beam line vacuum system, 6:22450

**VALUES**
**Sterilization**
Use of microorganisms in enhanced oil recovery, 6:21569 (DOE/BC/10300—10)

**VALVES**
**Failure Mode Analysis**
Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report, 6:21497 (DOE/ET/13537—T3)
**Materials Testing**
Evaluation of advanced materials in laboratory tests and pilot-plant service for use in liquefaction letdown valves. Final report, 6:21497 (DOE/ET/13537—T3)

**VAN DE GRAAFF ACCELERATORS**
**Voltage Regulators**
Improved two-loop beam energy stabilizer for an FN tandem accelerator, 6:22482 (DOE/ER/01388—489)

**VANADIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Degassing**
Gas release studies from explosion-cladded materials, 6:22922
**Ion Collisions**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**Leaching**
Correlation of mineralogy and trace element leaching behavior in modified in situ spent shales from Logan Wash, Colorado, 6:21616 (LA-UR—81-1196)
**Sputtering**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285

**VANADIUM 51 TARGET**
**Electron Reactions**
Exchange current effects in magnetic electron scattering from $^{49}$Ti, $^{51}$V, $^{59}$Co, $^{87}$Sr, and $^{93}$Nb, 6:22850

**VANADIUM SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581

**VAPOR-DOMINATED SYSTEMS**
**Computerized Simulation**
Performance matching and prediction for Serrazzano geothermal reservoir by means of numerical simulation, 6:21960 (LBL—12174)
**Reinjection**
Reinjection studies of vapor-dominated systems, 6:21968 (LBL—12175)

**VARIABILITY (GENETIC)**
*See GENETIC VARIABILITY*

**VEGETATION**
*See PLANTS*

**VEHICLES**
*See also AUTOMOBILES*
*ELECTRIC-POWERED VEHICLES*
**Fuel Economy**
Analyzing opportunities for energy conservation in municipal fleet management: service delivery patterns, equipment, supply, operations, and maintenance. Information bulletin of the energy task force of the urban consortium, 6:22226 (DOE/IR/05106—T23)
**Operation**
Analyzing opportunities for energy conservation in municipal fleet management: service delivery patterns, equipment, supply, operations, and maintenance. Information bulletin of the energy task force of the urban consortium, 6:22226 (DOE/IR/05106—T23)
**Procurement**
Analyzing opportunities for energy conservation in municipal fleet management: service delivery patterns, equipment, supply, operations, and maintenance. Information bulletin of the energy task force of the urban consortium, 6:22226 (DOE/IR/05106—T23)

**VERSENE**
*See EDTA*

**VESSELS (PRESSURE)**
*See PRESSURE VESSELS*

**VINYLCYANIDE**
*See ACRYLONITRILE*

**VIRUSES**
**Infectivity**
Early events in herpes simplex virus type 1 infection: photosensitivity of fluorescein isothiocyanate-treated virions, 6:22652

**Photosensitivity**
Early events in herpes simplex virus type 1 infection: photosensitivity of fluorescein isothiocyanate-treated virions, 6:22652
**VISION**
**Modulation**
Temporal modulation sensitivity of macaque monkeys, 6:22665
**VOLTAGE REGULATORS**
**Performance**
Improved two-loop beam energy stabilizer for an FN tandem accelerator, 6:22482 (DOE/ER/01388—489)
**VOLTAIC CELLS**
*See ELECTRIC BATTERIES*

## W

**WASHINGTON**
**Energy Sources**
Current energy research and development in Washington State, 1980, 6:22107 (WAOENG—80-17)
**Households**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
Pacific Northwest residential energy survey. Volume 4. Pacific Northwest cross-tabulations, 6:22181 (DOE/BP—13061(Vol.4))
Pacific Northwest residential energy survey. Volume 5. Washington cross-tabulations, 6:22182 (DOE/BP—13061(Vol.5))
**Magnetic Surveys**
Aerial radiometric and magnetic survey: Pullman National Topographic Map, Idaho/Washington. Final report, 6:21628 (GJBX—117(81))
Airborne gamma-ray spectrometer and magnetometer survey, Seattle quadrangle (Washington). Final report, 6:21631 (GJBX—135-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach quadrangle (Washington). Final report, 6:21630 (GJBX—135-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey, Cape Flattery quadrange (Washington). Final report, 6:21633 (GJBX—135-81(Vol.2D))
Airborne gamma-ray spectrometer and magnetometer survey, Wenatchee quadrangle (Washington). Final report, 6:21635 (GJBX—136-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach, Seattle, Cape Flattery, Victoria, Quadrangles (Washington). Final report, 6:21629 (GJBX—135-81(Vol.1))
Airborne gamma-ray spectrometer and magnetometer survey: Wenatchee, Concrete, quadrangles (Washington). Final report, 6:21634 (GJBX—136-81(Vol.1))
Airborne gamma-ray spectrometer and magnetometer survey: Concrete quadrangle (Washington). Final report, 6:21636 (GJBX—136-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey: Victoria quadrangle (Washington). Final report, 6:21632 (GJBX—135-81(Vol.2C))
**Radiometric Surveys**
Aerial radiometric and magnetic survey: Pullman National Topographic Map, Idaho/Washington. Final report, 6:21628 (GJBX—117(81))
Airborne gamma-ray spectrometer and magnetometer survey, Seattle quadrangle (Washington). Final report, 6:21631 (GJBX—135-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach quadrangle (Washington). Final report, 6:21630 (GJBX—135-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey, Cape Flattery quadrange (Washington). Final report, 6:21633 (GJBX—135-81(Vol.2D))
Airborne gamma-ray spectrometer and magnetometer survey, Wenatchee quadrangle (Washington). Final report, 6:21635 (GJBX—136-81(Vol.2A))
Airborne gamma-ray spectrometer and magnetometer survey, Copalis Beach, Seattle, Cape Flattery, Victoria, Quadrangles (Washington). Final report, 6:21629 (GJBX—135-81(Vol.1))
Airborne gamma-ray spectrometer and magnetometer survey: Wenatchee, Concrete, quadrangles (Washington). Final report, 6:21634 (GJBX—136-81(Vol.1))
Airborne gamma-ray spectrometer and magnetometer survey: Concrete quadrangle (Washington). Final report, 6:21636 (GJBX—136-81(Vol.2B))
Airborne gamma-ray spectrometer and magnetometer survey: Victoria quadrangle (Washington). Final report, 6:21632 (GJBX—135-81(Vol.2C))
**WASTE HEAT UTILIZATION**
**Aquaculture**
Overview of waste-heat-utilization techniques, 6:22110
**WASTE MANAGEMENT**
*See also RADIOACTIVE WASTE MANAGEMENT*
**Economic Analysis**
Regional resource recovery feasibility study for Western Piedmont and Centralina Council of Governments, 6:22254 (NCEI—0024)
**Feasibility Studies**
Regional resource recovery feasibility study for Western Piedmont and Centralina Council of Governments, 6:22254 (NCEI—0024)
**WASTE PROCESSING PLANTS**
**Data Compilation**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**Energy Conservation**
Energy conservation manual for water & wastewater facilities, 6:22251 (DOE/TIC—1021175)
**Energy Recovery**
Status report on energy recovery from municipal solid waste: technologies, lessons and issues. Information bulletin of the energy task force of the urban consortium, 6:22249 (DOE/IR/05106—T6)
**Surveys**
Waste-to-energy compendium. Final report, 6:22238 (DOE/CE/20167—05)
**WASTE WATER**
**Chemical Composition**
Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
**Dioxin**
Material balance approach to estimating aquatic exposure concentrations, 6:22587
**Environmental Effects**
Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
**Quantity Ratio**
Material balance approach to estimating aquatic exposure concentrations, 6:22587
**Recycling**
Wastewater treatment in the oil-shale industry, 6:21615 (LBL—11214)
**Waste Processing**
Treatment of coal coking and coal gasification wastewaters, 6:22651
Wastewater treatment in the oil-shale industry, 6:21615 (LBL—11214)
**Water Treatment**
Environmental aspects of alternative wet technologies for producing energy/fuel from peat. Final report, 6:21556 (DOE/FC/10169—T1)
**WASTE-FUELED POWER PLANTS**
*See REFUSE-FUELED POWER PLANTS*
**WATER**
*See also DRINKING WATER*
*FRESH WATER*
*GROUND WATER*
*HOT WATER*
*SEAWATER*
*SURFACE WATERS*
*WASTE WATER*

**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Chemical Analysis**
Detection of ultratrace levels of uranium in aqueous samples by laser-induced fluorescence spectrometry, 6:22340
**Chemical Reactions**
Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis, 6:22408
Reaction kinetics of nitrogen dioxide with liquid water at low partial pressure, 6:22369
**Compression**
Self-diffusion in compressed supercritical water, 6:22315
**Molecular Structure**
Loop-driven graphical unitary group approach applied to the MCSCF problem, 6:22779 (LBL—12157)
**NMR Spectra**
Self-diffusion in compressed supercritical water, 6:22315
**Radiolysis**
Pulse radiolysis of aqueous solutions of benzyltrialkylammonium cations: reactions with the primary transients from water radiolysis, 6:22408
**Self-Diffusion**
Self-diffusion in compressed supercritical water, 6:22315
**Titration**
Comparison of semiautomatic and fully automatic water titrators, 6:22327 (GEPP-TIS—569)

**WATER BRAKES**
**Performance**
Wind driven direct water heating system development and field testing, 6:21989
**Specifications**
Wind driven direct water heating system development and field testing, 6:21989

**WATER COOLED REACTORS**
*See also BWR TYPE REACTORS*
*HFIR REACTOR*
*PWR TYPE REACTORS*
**Gamma Fuel Scanning**
Examination of LWR irradiated fuel assemblies using simple ion chamber techniques, 6:22056

**WATER CURRENTS**
**Correlations**
Atmospheric carbon dioxide, the southern oscillation, and the weak 1975 El Nino, 6:22550

**WATER DISTRIBUTION**
*See WATER SUPPLY*

**WATER HEATERS**
*See also SOLAR WATER HEATERS*
**Energy Consumption**
Progress in residential energy conservation: a multi country perspective, 6:22206 (LBL—11701)
**Information**
Pacific Northwest residential energy survey. Volume 3. Question-by-question results, 6:22180 (DOE/BP—13061(Vol.3))
**Thermal Insulation**
Development of advanced insulation for appliances. Task I report, 6:22209 (ORNL/Sub—81/13800/1)

**WATER HEATING**
**Energy Demand**
Preliminary market analysis for customer side of the meter thermal-energy storage, 6:22193 (DOE/ET/26716—T1)

**WATER PUMPS**
**Design**
Redesign of turbine-pump impeller and diffuser using hydrodynamic design techniques. Final report, 6:22239 (DOE/CS/40183—T1)
**Efficiency**
Redesign of turbine-pump impeller and diffuser using hydrodynamic design techniques. Final report, 6:22239 (DOE/CS/40183—T1)

**WATER QUALITY**
**Monitoring**
Environmental monitoring report for calendar year 1980, 6:22552 (FERMILAB—81/26)

**WATER SUPPLY**
**Cost**
Projected effects of energy policies on agricultural water use and irrigation, 6:22101

**WATER TREATMENT PLANTS**
**Energy Conservation**
Energy conservation manual for water & wastewater facilities, 6:22251 (DOE/TIC—1021175)

**WATER VAPOR**
Water vapor pressure gauge, 6:22451
**Corrosive Effects**
Chemical durability improvement of glass shells, 6:22947

**WAVE FUNCTIONS**
**Optimization**
Recent developments in multiconfiguration wavefunction optimization, 6:22784 (LBL—12157)
**WKB Approximation**
Higher-order JWKB expressions for the energy levels and the wavefunction at the origin, 6:22823 (DOE/ER/03992—423)

**WAVE POWER**
**Research Programs**
Ocean energy conversion systems annual research report, 6:21843 (SERI/TR—634-1011)

**WAVES (SHOCK)**
*See SHOCK WAVES*

**WAZ 16**
*See NICKEL BASE ALLOYS*

**WEAPONS**
*See also NUCLEAR WEAPONS*
**Impact Shock**
On-board data recorder for hard-target weapons, 6:22530 (UCRL—85730)
**Performance Testing**
On-board data recorder for hard-target weapons, 6:22530 (UCRL—85730)

**WEIGHT**
**Genetic Variability**
Familial aggregation of blood pressure and weight in adoptive families: I. Comparisons of blood pressure and weight statistics among families with adopted, natural, or both natural and adopted children, 6:22641

**WELDED JOINTS**
**Stress Analysis**
Simplified inelastic analysis procedure to evaluate a butt-welded elbow end, 6:22034 (CONF-810625—16)

**WELDS**
*See WELDED JOINTS*

**WELL COMPLETION**
**Fillers**
Size distribution of LLNL coarse fill, 6:22463 (UCID—18286)

**WELL DRILLING**
**Bibliographies**
Geothermal technology publications and related reports: a bibliography, January 1977-December 1980, 6:21954 (SAND—81-0662)
**Corrosion Protection**
Pulsating-flow measurement with an orifice flange, 6:21971 (EGG—1183-1797)

**WELL LOGGING EQUIPMENT**
**Bibliographies**
Geothermal technology publications and related reports: a bibliography, January 1977-December 1980, 6:21954 (SAND—81-0662)

**WELL STIMULATION**
*See also HYDRAULIC FRACTURING*
**Explosive Fracturing**
Model studies of explosive well stimulation techniques, 6:21575
**Simulation**
Model studies of explosive well stimulation techniques, 6:21575

**WELLMAN-GALUSHA PROCESS**
**Comparative Evaluations**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)

Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)

**WESTINGHOUSE GASIFICATION PROCESS**
Westinghouse coal gasification system, 6:21532

**WIGGLER MAGNETS**
**Reviews**
Wigglers: the newest profession, 6:22495 (SLAC-PUB—2677)

**WILD ANIMALS**
**Blood Chemistry**
Bioindicators of the health of arctic foxes (Alopex lagopus), 6:22660 (PNL-SA—9197)
**RNA**
Bioindicators of the health of arctic foxes (Alopex lagopus), 6:22660 (PNL-SA—9197)

**WIND**
**Correlations**
Atmospheric carbon dioxide, the southern oscillation, and the weak 1975 El Nino, 6:22550
**Monitoring**
Description of the wind profile system developed for the PLACES test series, 6:22744 (SAND—81-0482)

**WIND POWER**
**Acoustic Monitoring**
Review of remote-sensor potential for wind-energy studies, 6:21983 (DOE/ET/23151—80/1)
**Availability**
Federal Wind Energy Program for wind resource assessment and siting: an overview, 6:21981
Wind characteristics in suthern Wyoming, 6:21982
**Monitoring**
Candidate wind turbine generator site annual data summary for January 1980 through December 1980, 6:21985 (PNL—3739)
Review of remote-sensor potential for wind-energy studies, 6:21983 (DOE/ET/23151—80/1)
**Optical Radar**
Review of remote-sensor potential for wind-energy studies, 6:21983 (DOE/ET/23151—80/1)
**Resource Assessment**
Federal Wind Energy Program for wind resource assessment and siting: an overview, 6:21981
Guidebook on wind energy-conversion applications in Hawaii, 6:21980 (HNEI—81-01)
Wind characteristics in suthern Wyoming, 6:21982

**WIND POWER PLANTS**
**Demonstration Programs**
Large wind turbines: early operational experience and potential for supplying electricity, 6:21979
**Feasibility Studies**
Large wind turbines: early operational experience and potential for supplying electricity, 6:21979
**Inverters**
Loss of line shutdown for line-commutated utility-interactive inverter, 6:21815 (DOE/ET/20279—128)
**Marketing Research**
Northeast regional assessment study for solar electric options in the period 1980-2000, 6:21837 (DOE/ET/20375—T1)
**Site Selection**
Federal Wind Energy Program for wind resource assessment and siting: an overview, 6:21981

**WIND TURBINES**
**Feasibility Studies**
Guidebook on wind energy-conversion applications in Hawaii, 6:21980 (HNEI—81-01)
**Space Heating**
Wind energy for agricultural heating, 6:21990
**Turbine Blades**
Test evaluation of a laminated wood wind turbine blade concept, 6:21984 (DOE/NASA/20320—30)

**WINDOWS**
**Design**
Windows for accepting or rejecting solar heat gain, 6:21905
**Heat Gain**
Windows for accepting or rejecting solar heat gain, 6:21905

**WINKLER PROCESS**
**Comparative Evaluations**
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21508 (DOE/RA/20222—T1)
Low/medium Btu coal gasification assessment of central plant for the city of Philadelphia, Pennsylvania. Final report, 6:21509 (DOE/RA/20222—T2)

**WINSTON COLLECTORS**
*See COMPOUND PARABOLIC CONCENTRATORS*

**WNP-1 REACTOR**
**Thermal Effluents**
Economics of power plant district and process heating in Richland, Washington, 6:22255 (PNL—3719)

**WOMEN**
**Immunoglobulins**
Gm allotypes in mother-father-cord trios: a selective transfer of autologous, fetal IgG to the mother, 6:22667
IgG levels in mother-father-cord trios: evidence for a large reduction of maternal IgG at birth, 6:22668

**WOOD**
**Acid Hydrolysis**
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980 (Autohydrolysis), 6:21729 (SERI/TR—98174-1)
**Anaerobic Digestion**
Heat treatment of organics for increasing anaerobic biodegradability. Annual progress report, June 16, 1979-August 31, 1980 (Autohydrolysis), 6:21729 (SERI/TR—98174-1)

**WOOD WASTES**
**Combustion**
Energy generation & cogeneration from wood, 6:21734

**WORKERS**
*See PERSONNEL*

**WPPSS NUCLEAR PROJECT NO. 1**
*See WNP-1 REACTOR*

**WYOMING**
**Magnetic Surveys**
Aerial radiometric and magnetic survey: Driggs National Topographic Map, Idaho/Wyoming. Final report, 6:21623 (GJBX—93(81))
**Radiometric Surveys**
Aerial radiometric and magnetic survey: Driggs National Topographic Map, Idaho/Wyoming. Final report, 6:21623 (GJBX—93(81))
**Wind Power**
Wind characteristics in suthern Wyoming, 6:21982

## X

**X RADIATION**
**Scattering**
Anomalous scattering of X-rays by cesium and cobalt measured with synchrotron radiation, 6:22857

**XENON**
**Hyperfine Structure**
Doppler-canceled, two-photon resonant ionization spectroscopy, 6:22805
**Ionization**
Doppler-canceled, two-photon resonant ionization spectroscopy, 6:22805
**Photoionization**
Atomic structure calculations using the relativistic random phase approximation, 6:22755 (ANL—80-126)

**XENON IONS**
**Dissociation Energy**
Geometry and spectral properties of $Ne^{+}_{3}$, $Ar^{+}_{3}$, $Kr^{+}_{3}$, and $Xe^{+}_{3}$, 6:22793

**X-RAY RADIOGRAPHY**
**Image Processing**
PHERMEX applications to study high-pressure flow and detonation waves, 6:22524 (LA-UR—81-1270)

**X-RAY SPECTRA**
**Scintillation Counters**
Analysis of x-ray emission and tritium content from glass Microshell inertial fusion targets, 6:22945

## Y

**Y-12 PLANT**
**Energy Conservation**
UCC-ND engineering program, 6:22171 (CONF-8003114—)
**Energy Management Systems**
Energy management and control system, Y-12 Plant, 6:22172 (CONF-8003114—)
**Steam Generation**
Co-generation, 6:22236 (CONF-8003114—)
**YANG-MILLS THEORY**
**Gauge Invariance**
High-temperature Yang-Mills theories and three-dimensional quantum chromodynamics, 6:22828
**Integral Equations**
Is Yang-Mills equation a totally integrable system. Lecture III, 6:22834 (BNL—29546)
**Magnetic Monopoles**
Construction of exact Yang-Mills-Higgs multimonopoles of arbitrary charge, 6:22842
**YANKEE ROWE REACTOR**
*See ROWE YANKEE REACTOR*
**YTTERBIUM**
**Activation Analysis**
Flagstaff 1° x 2° NTMS area Arizona: data report (abbreviated), 6:21637 (GJBX—137(81))
Marble Canyon 1° x 2° NTMS area Arizona: data report, 6:21638 (GJBX—138(81))
**Solvent Extraction**
Mixed ligand chelate extraction of lanthanides with 5,7-dibromo-8-quinolinol systems, 6:22344
**YTTERBIUM COMPOUNDS**
**Valence**
Electrochemical and spectroscopic studies of some less stable oxidation states of selected lanthanide and actinide elements, 6:22363 (DOE/ER/04447—124)
**YTTERBIUM PHOSPHATES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**YTTRIUM**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**YTTRIUM IONS**
**Energy-Level Transitions**
3d—4p transitions in the zinclike and copperlike ions Y X, XI; Zr XI, XII; Nb XII, XIII; and Mo XIII, XIV, 6:22281
**YTTRIUM PHOSPHATES**
**Crystal Structure**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)
**Leaching**
Review of research on analogs of monazite for the isolation of actinide wastes, 6:21656 (CONF-8005107—)

## Z

**ZEA MAYS**
*See MAIZE*
**ZERO POWER REACTORS**
**Specifications**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**Tables**
Nuclear reactors built, being built, or planned in the United States as of December 31, 1980, 6:22023 (DOE/TIC—8200-R43)
**ZINC**
**Absorption Spectroscopy**
Portland 1° x 2° NTMS area: Maine and New Hampshire. Supplemental data report: National Uranium Resource Evaluation Program, hydrogeochemical and stream sediment reconnaissance, 6:21624 (GJBX—106-81)
**ZINC COMPLEXES**
**Structural Chemical Analysis**
$^{15}N$ NMR study of complexation of 1-methylimidazole by zinc(II) and cadmium(II) in aqueous soltuion, 6:22389
**ZINC IONS**
**Energy Levels**
Energy levels of highly ionized atoms, 6:22762 (ANL—80-126)
**Ultraviolet Spectra**
Energy levels of highly ionized atoms, 6:22762 (ANL—80-126)
**ZINC PHOSPHIDE SOLAR CELLS**
**Fabrication**
$Zn_3P_2$ as an improved semiconductor for photovoltaic solar cells. Eighth quarterly report, June 1-August 31, 1980, 6:21792 (SERI/PR—80062-1-T1)
**Performance**
$Zn_3P_2$ as an improved semiconductor for photovoltaic solar cells. Eighth quarterly report, June 1-August 31, 1980, 6:21792 (SERI/PR—80062-1-T1)
**ZINC SULFATES**
**Decomposition**
Proposed solar-furnace study of zinc sulfate decomposition, 6:21722 (UCRL—85743)
**ZINC-BROMINE BATTERIES**
**Cost**
Recent technology improvements in Exxon's circulating zinc-bromine battery system, 6:22094 (SAND—81-7116C)
**Design**
Recent progress on Exxon's circulating zinc bromine battery system, 6:22093 (SAND—81-7115C)
**Performance**
Recent progress on Exxon's circulating zinc bromine battery system, 6:22093 (SAND—81-7115C)
Recent technology improvements in Exxon's circulating zinc-bromine battery system, 6:22094 (SAND—81-7116C)
**Uses**
Recent technology improvements in Exxon's circulating zinc-bromine battery system, 6:22094 (SAND—81-7116C)
**ZIRCALOY**
**Stress Corrosion**
Stress corrosion cracking of zircaloy by metal iodides and cadmium, 6:22274 (LBL—12548)
**ZIRCONIUM**
**Ion Collisions**
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**Sputtering**
Laser fluorescence spectroscopy of sputtered zirconium atoms, 6:22803
Measurement of neutral and ion sputtering yields by matrix isolation spectroscopy, 6:22285
**ZIRCONIUM ALLOYS**
Effect of hydrogen glow discharge conditioning on Zr/Al getter pumps, 6:22929
**Adsorption**
Co adsorption on Al-Zr at room temperature, 6:22926
**ZIRCONIUM IONS**
**Energy-Level Transitions**
3d—4p transitions in the zinclike and copperlike ions Y X, XI; Zr XI, XII; Nb XII, XIII; and Mo XIII, XIV, 6:22281

**ZIRCONIUM OXIDES**
**Vapor Plating**
Development of improved corrosion- and erosion-resistance coatings for gas-turbine airfoils, 6:21999 (DOE/ET/12292—T1)
**ZIRCONIUM SULFIDES**
**Electronic Structure**
Electronic structure of hydrodesulfurization catalysts, 6:21581
**ZONES (AURORAL)**
*See AURORAL ZONES*
**ZT-40 DEVICES**
**Plasma Diagnostics**
Eight-chord $CO_2$ interferometer for plasma-density measurements on ZT-40, 6:22880 (LA-UR—81-1148)

# CONTRACT NUMBER INDEX

Numbers assigned to DOE contracts under which reports announced in this publication were prepared are included in this index.


| *Contract No.* | *Abstract No.* | *Report No.* |
|---|---|---|
| **AB01-76CS31020** | **Boeing Co., Seattle, WA (USA)** | |
| | 6:21874 | SOLAR/1025—81/50 |
| | 6:21935 | SOLAR/1044—80/50 |
| **AB01-77ET10069** | **Exxon Research and Engineering Co., Florham Park, NJ (USA)** | |
| | 6:21492 | DOE/ET/10069—T5 |
| **AB18-78FC02101** | **North Dakota Univ., Grand Forks (USA)** | |
| | 6:21502 | DOE/FC/02101—T1 |
| **AC01-76CS20167** | **National Center for Resource Recovery, Inc., Washington, DC (USA)** | |
| | 6:22238 | DOE/CE/20167—05 |
| **AC01-76CS40284** | **Massachusetts Inst. of Tech., Cambridge (USA)** | |
| | 6:22267 | DOE/CS/40284—T1 |
| **AC01-76ET10340** | **General Electric Co., Schenectady, NY (USA). Gas Turbine Div.** | |
| | 6:21994 | DOE/ET/10340—T3 |
| | 6:21995 | DOE/ET/10340—T4 |
| **AC01-76ET10348** | **Curtiss-Wright Corp., Wood-Ridge, NJ (USA). Power Systems Div.** | |
| | 6:21996 | DOE/ET/10348—T2 |
| **AC01-76ET10501** | **Combustion Engineering, Inc., Windsor, CT (USA)** | |
| | 6:21991 | CONF-790145—4 |
| **AC01-76ET10780** | **Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.** | |
| | 6:22144 | DOE/ET/10780—T1 |
| **AC01-76PE03784** | **National Research Council, Washington, DC (USA). Committee on Nuclear and Alternative Energy Systems** | |
| | 6:22097 | DOE/PE/03784—T1 |
| **AC01-77CS40079** | **Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.** | |
| | 6:22266 | CONS—5089-15 |
| **AC01-77ET13060** | **Conoco, Inc., Stamford, CT (USA)** | |
| | 6:21495 | DOE/ET/13060—T2 |
| | 6:21535 | DOE/ET/13060—T1 |
| **AC01-78CS35243** | **Martin Marietta Corp., Denver, CO (USA). Denver Aerospace** | |
| | 6:21863 | MCR—81-543 |
| **AC01-78CS40037** | **Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.** | |
| | 6:21558 | DOE/CS/40037—T1 |
| | 6:21559 | DOE/CS/40037—T2 |
| **AC01-78CS40183** | **Aerospace Research Corp., Roanoke, VA (USA)** | |
| | 6:22239 | DOE/CS/40183—T1 |
| **AC01-78ET13114** | **Energy Research Corp., Danbury, CT (USA)** | |
| | 6:22162 | DOE/NASA/0067—79-6 |
| **AC01-78ET26716** | **Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)** | |
| | 6:22193 | DOE/ET/26716—T1 |
| **AC01-78ET29068** | **Westinghouse Electric Corp., Trafford, PA (USA). Power Circuit Breaker Div.** | |
| | 6:22012 | DOE/ET/29068—T5 |
| **AC01-78RG06668** | **New York State Dept. of Public Services, Albany (USA)** | |
| | 6:22133 | DOE/RG/06668—T1 |
| **AC01-79CS20524** | **AIA Research Corp., Washington, DC (USA)** | |
| | 6:22194 | DOE/TIC—11453 |
| **AC01-79CS30027** | **Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.** | |
| | 6:21741 | SOLAR/0010—81/04 |
| | 6:21866 | SOLAR/0005—81/80 |
| | 6:21875 | SOLAR/1039—81/14 |
| | 6:21876 | SOLAR/1050—81/14 |
| **AC01-79ET13537** | **Battelle Columbus Labs., OH (USA)** | |
| | 6:21497 | DOE/ET/13537—T3 |
| **AC01-79ET14801** | **Air Products and Chemicals, Inc., Allentown, PA (USA)** | |
| | 6:21498 | DOE/ET/14801—12 |
| **AC01-79ET15518** | **Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.** | |
| | 6:22145 | DOE/ET/15518—3 |
| **AC01-79ET21109** | **G K Systems, Inc., Westlake Village, CA (USA)** | |
| | 6:21941 | DOE/ET/21109—T1 |
| **AC01-79ET32043** | **General Electric Co., Philadelphia, PA (USA). Space Div.** | |
| | 6:22153 | DOE/ET/32043—T7 |
| **AC01-80CS40352** | **Centec Corp., Reston, VA (USA)** | |
| | 6:21732 | DOE/CS/40352—T2 |
| **AC01-80EI10313** | **MAXIMA Corp., Bethesda, MD (USA)** | |
| | 6:22989 | DOE/EIA/10313—T4 |
| **AC01-80ER53106** | **Ogden (Joan M.), Princeton, NJ (USA)** | |
| | 6:22877 | DOE/ER/53106—T1 |
| **AC01-80ET15602** | **FluiDyne Engineering Corp., Minneapolis, MN (USA)** | |
| | 6:22149 | DOE/ET/15602—T4 |
| **AC01-80ET15619** | **Reynolds Metals Co., Sheffield, AL (USA). Energy Conversion Div.** | |
| | 6:22150 | DOE/ET/15619—T1 |
| **AC02-76CH00016** | **Brookhaven National Lab., Upton, NY (USA)** | |
| | 6:22169 | BNL—29480 |
| | 6:22481 | BNL—29243 |
| | 6:22736 | BNL—29440 |
| | 6:22737 | BNL—29527 |
| | 6:22817 | BNL—29465 |
| | 6:22822 | BNL—29468 |
| | 6:22834 | BNL—29546 |
| | 6:22843 | DOE/NDC—22/U |
| | 6:22858 | BNL-NCS—29035 |
| **AC02-76CH03000** | **Fermi National Accelerator Lab., Batavia, IL (USA)** | |
| | 6:22552 | FERMILAB—81/26 |
| | 6:22824 | FERMILAB-Conf—80/64THY |
| **AC02-76ER01198** | **Illinois Univ., Urbana (USA)** | |
| | 6:21536 | DOE/ER/01198—1351 |
| | 6:22268 | DOE/ER/01198—1352 |
| **AC02-76ER02271** | **Columbia Univ., New York (USA). Dept. of Physics** | |
| | 6:22835 | DOE/ER/02271—T2 |
| **AC02-76ER03072** | **Princeton Univ., NJ (USA). Joseph Henry Labs.** | |
| | 6:22483 | DOE/ER/03072—1 |
| **AC02-76ET11293** | **Rasor Associates, Inc., Sunnyvale, CA (USA)** | |
| | 6:22154 | DOE/ET/11293—T3 |
| **AC02-76ET11304** | **Energy Research Corp., Danbury, CT (USA)** | |
| | 6:22157 | DOE/ET/11304—T7 |
| | 6:22158 | DOE/ET/11304—T10 |
| **AC02-76ET11305** | **Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center** | |
| | 6:22159 | DOE/ET/11305—T8 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| **AC02-76ET20279** | **Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.** | |
| | 6:21762 | DOE/ET/20279—134 |
| | 6:21813 | DOE/ET/20279—118 |
| | 6:21814 | DOE/ET/20279—123 |
| | 6:21815 | DOE/ET/20279—128 |
| | 6:21816 | DOE/ET/20279—132 |
| | 6:21817 | DOE/ET/20279—133 |
| | 6:21818 | DOE/ET/20279—135 |
| | 6:21819 | DOE/ET/20279—138 |
| | 6:21940 | DOE/ET/20279—137 |
| **AC02-76EV03490** | **Rochester Univ., NY (USA). Dept. of Radiation Biology and Biophysics** | |
| | 6:22631 | UR—3490/LCP-22 |
| **AC02-77CH00178** | **Stanford Univ., CA (USA). Dept. of Civil Engineering** | |
| | 6:21729 | SERI/TR—98174-1 |
| | 6:21730 | SERI/TR—98175-1 |
| | 6:21753 | SERI/TR—434-423 |
| | 6:21781 | SERI/PR—8041-16-T1 |
| | 6:21782 | SERI/PR—8063-1-T1 |
| | 6:21783 | SERI/PR—8063-1-T3 |
| | 6:21784 | SERI/PR—8063-1-T4 |
| | 6:21785 | SERI/PR—8309-1-T4 |
| | 6:21786 | SERI/PR—9190-1-T1 |
| | 6:21787 | SERI/PR—9219-T1 |
| | 6:21788 | SERI/PR—9234-2-T1 |
| | 6:21789 | SERI/PR—9237-1-T2 |
| | 6:21790 | SERI/PR—9354-T1 |
| | 6:21791 | SERI/PR—9372-1-T1 |
| | 6:21792 | SERI/PR—80062-1-T1 |
| | 6:21793 | SERI/TP—612-1190 |
| | 6:21794 | SERI/TR—8063-1-T2 |
| | 6:21843 | SERI/TR—634-1011 |
| | 6:21949 | SERI/TR—731-587 |
| **AC02-77CS20068** | **Georgetown Univ., Washington, DC (USA)** | |
| | 6:22192 | DOE/CS/20068—4(Vol.2)(App.) |
| **AC02-77ET10466** | **Center for the Environment and Man, Inc., Hartford, CT (USA)** | |
| | 6:21542 | DOE/ET/10466—T1 |
| **AC02-77ET26214** | **Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.** | |
| | 6:22269 | DOE/ET/26214—T1 |
| **AC02-77ET35202** | **General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.** | |
| | 6:22047 | DOE/ET/35202—T1(Vol.1) |
| **AC02-78ET21002** | **VSE Corp., Alexandria, VA (USA)** | |
| | 6:21842 | DOE/ET/21002—T14 |
| **AC02-79CS20220** | **Stein (Richard G.) and Partners, New York (USA)** | |
| | 6:22190 | DOE/CE/20220—1 |
| **AC02-79ER10514** | **Kansas State Univ., Manhattan (USA)** | |
| | 6:22770 | CONF-810432—4 |
| **AC02-79ET15423** | **SRI International, Menlo Park, CA (USA). Engineering Sciences Lab.** | |
| | 6:22155 | DOE/ET/15423—5 |
| | 6:22156 | DOE/ET/15423—6 |
| **AC02-79ET15426** | **Northern Research and Engineering Corp., Woburn, MA (USA)** | |
| | 6:22243 | DOE/ET/15426—4 |
| **AC02-79ET34013** | **Combustion Engineering, Inc., Windsor, CT (USA)** | |
| | 6:22046 | DOE/ET/34013—T1 |
| **AC02-79EV10237** | **Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry** | |
| | 6:21501 | DOE/EV/10237—2 |
| **AC02-80CS24310** | **Ohio State Univ., Columbus (USA). Dept. of Civil Engineering** | |
| | 6:21726 | DOE/CS/24310—3 |
| **AC02-80ET17103** | **Catalytica Associates, Inc., Santa Clara, CA (USA)** | |
| | 6:22160 | DOE/ET/17103—2 |
| **AC03-76ER00511** | **Hawaii Univ., Honolulu (USA)** | |
| | 6:22511 | DOE/ER/00511—T1 |
| **AC03-76ET12056** | **Stanford Univ., CA (USA). Petroleum Research Inst.** | |
| | 6:21570 | DOE/ET/12056—11 |
| **AC03-76SF00515** | **Stanford Linear Accelerator Center, CA (USA)** | |
| | 6:22470 | SLAC-PUB—2666 |
| | 6:22471 | SLAC-PUB—2670 |
| | 6:22472 | SLAC-PUB—2672 |
| | 6:22473 | SLAC-PUB—2673 |
| | 6:22474 | SLAC-PUB—2678 |
| | 6:22475 | SLAC-PUB—2683 |
| | 6:22476 | SLAC-PUB—2688 |
| | 6:22477 | SLAC-PUB—2690 |
| | 6:22478 | SLAC-PUB—2700 |
| | 6:22493 | SLAC-PUB—2664 |
| | 6:22494 | SLAC-PUB—2675 |
| | 6:22495 | SLAC-PUB—2677 |
| | 6:22496 | SLAC-PUB—2682 |
| | 6:22497 | SLAC-PUB—2684 |
| | 6:22498 | SLAC-PUB—2689 |
| | 6:22499 | SLAC-PUB—2691 |
| | 6:22500 | SLAC-PUB—2698 |
| | 6:22501 | SLAC-PUB—2701 |
| | 6:22502 | SLAC-PUB—2702 |
| | 6:22503 | SLAC-PUB—2703 |
| | 6:22504 | SLAC-PUB—2704 |
| | 6:22508 | DOE/SF/00515—T1 |
| | 6:22825 | SLAC-PUB—2674 |
| **AC03-77CS31587** | **Carrier Corp., Syracuse, NY (USA). Energy Systems Div.** | |
| | 6:21851 | DOE/CS/31587—T2 |
| **AC03-78ET12292** | **Airco Temescal Div., Berkeley, CA (USA)** | |
| | 6:21999 | DOE/ET/12292—T1 |
| **AC03-78ET12366** | **Gary Energy Corp., Englewood, CO (USA)** | |
| | 6:21572 | DOE/ET/12366—22 |
| **AC03-78SF02034** | **Advanced Energy Concepts, San Diego, CA (USA)** | |
| | 6:22048 | DOE/SF/02034—T14 |
| **AC03-79CS10757** | **Science Applications, Inc., La Jolla, CA (USA)** | |
| | 6:22213 | SAI—444-80-299-LJ |
| **AC03-79ET23037** | **Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences** | |
| | 6:21763 | DOE/ET/23037—2 |
| | 6:21764 | DOE/ET/23037—3 |
| | 6:22311 | DOE/ET/23037—4 |
| **AC03-79ET27233** | **Hawaiian Dredging and Construction Co., Honolulu (USA). Advanced Projects Dept.** | |
| | 6:21977 | DOE/ET/27233—T3 |
| **AC03-79SF10549** | **E-Tech, Inc., Atlanta, GA (USA)** | |
| | 6:21859 | DOE/SF/10549—T1 |
| **AC03-79SF10606** | **Foster Wheeler Development Corp., Livingston, NJ (USA)** | |
| | 6:21860 | DOE/SF/10606—T1 |
| **AC03-79SF10608** | **McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)** | |
| | 6:21864 | MDC-G—8163A |
| **AC03-79SF10756** | **Bechtel National, Inc., San Francisco, CA (USA)** | |
| | 6:21838 | DOE/SF/10756—1 |
| **AC03-80CS30224** | **FAFCO, Inc., Menlo Park, CA (USA)** | |
| | 6:21848 | DOE/CS/30224—T1 |
| **AC03-81ER52071** | **TRW Defense and Space Systems Group, Redondo Beach, CA (USA)** | |
| | 6:22911 | DOE/ER/52071—T1 |
| **AC04-76DP00053** | **Mound Facility, Miamisburg, OH (USA)** | |
| | 6:22424 | MLM—2826 |
| **AC04-76DP00487** | **Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)** | |
| | 6:22525 | MHSMP—81-25 |
| **AC04-76DP00613** | **Bendix Corp., Kansas City, MO (USA)** | |
| | 6:22417 | BDX—613-2620 |
| **AC04-76DP00656** | **General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.** | |
| | 6:22327 | GEPP-TIS—569 |
| **AC04-76DP00789** | **Sandia National Labs., Albuquerque, NM (USA)** | |
| | 6:21546 | SAND—81-1069C |
| | 6:21573 | SAND—81-0101C |
| | 6:21594 | SAND—80-2871 |
| | 6:21595 | SAND—80-7140 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| | 6:21603 | SAND—81-0225 |
| | 6:21604 | SAND—81-0703 |
| | 6:21610 | SAND—81-1038 |
| | 6:21650 | SAND—81-0605C |
| | 6:21684 | SAND—80-2016 |
| | 6:21685 | SAND—80-2096 |
| | 6:21698 | SAND—81-0495C |
| | 6:21747 | SAND—81-0048 |
| | 6:21773 | SAND—80-0216 |
| | 6:21774 | SAND—80-2206C |
| | 6:21775 | SAND—81-0069 |
| | 6:21776 | SAND—81-1145C |
| | 6:21777 | SAND—81-1191C |
| | 6:21778 | SAND—81-1211C |
| | 6:21779 | SAND—81-1222C |
| | 6:21780 | SAND—81-7113C |
| | 6:21823 | SAND—81-0897 |
| | 6:21824 | SAND—81-1193C |
| | 6:21839 | SAND—81-0113 |
| | 6:21945 | SAND—80-1583 |
| | 6:21946 | SAND—81-0290 |
| | 6:21947 | SAND—81-0313 |
| | 6:21948 | SAND—81-0385 |
| | 6:21954 | SAND—81-0662 |
| | 6:21973 | SAND—81-7066 |
| | 6:21986 | SAND—80-2669 |
| | 6:21987 | SAND—80-2776 |
| | 6:21988 | SAND—81-1108C |
| | 6:22025 | ALO—137 |
| | 6:22062 | SAND—81-0749C |
| | 6:22093 | SAND—81-7115C |
| | 6:22094 | SAND—81-7116C |
| | 6:22095 | SAND—81-7119C |
| | 6:22259 | SAND—81-8642 |
| | 6:22278 | SAND—81-0147C |
| | 6:22279 | SAND—81-0558C |
| | 6:22337 | SAND—81-0331C |
| | 6:22426 | SAND—80-1987 |
| | 6:22427 | SAND—80-2549C |
| | 6:22456 | SAND—81-0658C |
| | 6:22518 | SAND—81-0126C |
| | 6:22521 | SAND—81-0196 |
| | 6:22526 | SAND—80-1880C |
| | 6:22731 | SAND—81-7063 |
| | 6:22744 | SAND—81-0482 |
| | 6:22745 | SAND—81-0483 |
| | 6:22787 | SAND—81-0203C |
| | 6:22976 | SAND—81-0691C |
| | 6:22977 | SAND—81-0994 |
| **AC04-76DP03533** | **Rockwell International Corp., Golden, CO (USA). Energy Systems Group** | |
| | 6:22277 | RFP—3049 |
| **AC04-78CS30133** | **Westinghouse Research and Development Center, Pittsburgh, PA (USA)** | |
| | 6:21937 | DOE/CS/30133—T1(Vol.1) |
| | 6:21938 | DOE/CS/30133—T1(Vol.2) |
| **AC04-78CS35349** | **InterTechnology/Solar Corp., Warrenton, VA (USA)** | |
| | 6:21939 | DOE/CS/35349—T1 |
| **AC05-76CS20100** | **Systems Technology Corp., Xenia, OH (USA)** | |
| | 6:22256 | DOE/CS/20100—T2 |
| **AC05-76OR00033** | **Institute for Energy Analysis, Oak Ridge, TN (USA)** | |
| | 6:21591 | ORAU/IEA—81-3(M) |
| | 6:22081 | ORAU/IEA—81-4(M) |
| | 6:22167 | ORAU/IEA—81-1(M) |
| **AC05-78ER05911** | **Austin Research Associates, Inc., TX (USA)** | |
| | 6:22484 | DOE/ER/05911—T1 |
| **AC05-78ET13511** | **Westinghouse Electric Corp., Tampa, FL (USA). Nuclear Equipment Div.** | |
| | 6:22051 | DOE/OR/13511—T1 |
| **AC05-79CS56051** | **Mueller Associates, Inc., Baltimore, MD (USA)** | |
| | 6:22140 | DOE/CE/56051—3 |
| **AC06-76ER01388** | **Washington Univ., Seattle (USA). Nuclear Physics Lab.** | |
| | 6:22466 | DOE/ER/01388—488 |
| | 6:22482 | DOE/ER/01388—489 |
| **AC06-76RL01830** | **Battelle Pacific Northwest Labs., Richland, WA (USA)** | |
| | 6:21516 | PNL-SA—8812 |
| | 6:21649 | ONWI—189 |
| | 6:21665 | DOE/NWTS—33(1) |
| | 6:21675 | ONWI—9(3)(1980) |
| | 6:21676 | ONWI—75 |
| | 6:21677 | ONWI—124 |
| | 6:21678 | ONWI—203 |
| | 6:21679 | ONWI—234 |
| | 6:21680 | PNL—3702 |
| | 6:21681 | PNL-SA—9092 |
| | 6:21682 | PNL-SA—9231 |
| | 6:21692 | PNL—3817 |
| | 6:21772 | PNL-SA—9464 |
| | 6:21978 | PNL—3435 |
| | 6:21985 | PNL—3739 |
| | 6:22089 | PNL—3746 |
| | 6:22212 | PNL—3312 |
| | 6:22255 | PNL—3719 |
| | 6:22425 | PNL-SA—8797 |
| | 6:22660 | PNL-SA—9197 |
| | 6:22725 | PNL-SA—9096 |
| | 6:22861 | PNL-SA—9333 |
| **AC06-77ET20375** | **JBF Scientific Corp., Wilmington, MA (USA)** | |
| | 6:21837 | DOE/ET/20375—T1 |
| **AC06-77RL01030** | **Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations** | |
| | 6:21683 | RHO-CD—972 |
| | 6:22336 | RHO-SA—218 |
| **AC06-77RL90283** | **Stearns-Roger Services, Inc., Denver, CO (USA)** | |
| | 6:21679 | ONWI—234 |
| **AC07-76ET15350** | **Biphase Energy Systems, Santa Monica, CA (USA)** | |
| | 6:22242 | DOE/ET/15350—1 |
| **AC07-76ID01570** | **EG and G Idaho, Inc., Idaho Falls (USA)** | |
| | 6:21976 | CONF-810471—1 |
| | 6:22026 | GEND—016 |
| | 6:22071 | CONF-810406—4 |
| | 6:22074 | EGG-M—00881 |
| | 6:22076 | GEND—007 |
| | 6:22971 | CONF-810406—5 |
| | 6:22972 | CONF-810406—7 |
| | 6:22973 | EGG-EA—5455 |
| **AC07-79ID01675** | **Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)** | |
| | 6:21671 | ENICO—1087 |
| **AC08-76NV00597** | **Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.** | |
| | 6:21648 | DOE/NV/00597—5 |
| **AC08-76NV01183** | **Rice Univ., Houston, TX (USA)** | |
| | 6:21621 | GJBX—69(81) |
| | 6:21971 | EGG—1183-1797 |
| | 6:22442 | EGG—1183-1800 |
| | 6:22528 | EGG—1183-4221 |
| | 6:22743 | CONF-810421—3 |
| **AC08-79BC10003** | **CER Corp., Las Vegas, NV (USA)** | |
| | 6:21602 | DOE/BC/10003—18 |
| **AC08-79DP40109** | **TRW Defense and Space Systems Group, Redondo Beach, CA (USA)** | |
| | 6:22917 | LA-UR—81-1408 |
| **AC08-79ET27111** | **Texas Univ., Austin (USA). Bureau of Economic Geology** | |
| | 6:21958 | DOE/ET/27111—2 |
| **AC09-76SR00001** | **Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.** | |
| | 6:21624 | GJBX—106-81 |
| | 6:21637 | GJBX—137(81) |
| | 6:21638 | GJBX—138(81) |
| | 6:21669 | DP-MS—80-123 |
| | 6:21670 | DP-MS—81-8 |
| | 6:22054 | DP-MS—80-120 |
| | 6:22542 | DP-MS—80-84 |
| | 6:22543 | DP-MS—80-85 |
| | 6:22729 | DP-MS—80-119 |
| **AC09-77ET12866** | **South Carolina Energy Research Inst., Columbia (USA)** | |
| | 6:22241 | DOE/ET/12866—3 |
| **AC11-76PN00014** | **Bettis Atomic Power Lab., West Mifflin, PA (USA)** | |
| | 6:22041 | WAPD-TM—1385 |
| | 6:22042 | WAPD-TM—1386 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| **AC11-76PN00292** | **Duquesne Light Co., Shippingport, PA (USA)** | |
| | 6:22057 | DOE/PN/00293—T1 |
| **AC13-76GH01664** | **Geodata International, Inc., Dallas, TX (USA)** | |
| | 6:21620 | GJBX—35((81)(Vol.2)(PriceSalina) |
| **AC13-76GJ01664** | **Bendix Field Engineering Corp., Grand Junction, CO (USA)** | |
| | 6:21622 | GJBX—80(81) |
| | 6:21623 | GJBX—93(81) |
| | 6:21625 | GJBX—110-81 |
| | 6:21626 | GJBX—111(81) |
| | 6:21627 | GJBX—112(81) |
| | 6:21628 | GJBX—117(81) |
| | 6:21629 | GJBX—135-81(Vol.1) |
| | 6:21639 | GJBX—141(81) |
| **AC13-79GJ01692** | **High Life Helicopters, Inc., Puyallup, WA (USA)** | |
| | 6:21629 | GJBX—135-81(Vol.1) |
| | 6:21630 | GJBX—135-81(Vol.2A) |
| | 6:21631 | GJBX—135-81(Vol.2B) |
| | 6:21632 | GJBX—135-81(Vol.2C) |
| | 6:21633 | GJBX—135-81(Vol.2D) |
| | 6:21634 | GJBX—136-81(Vol.1) |
| | 6:21635 | GJBX—136-81(Vol.2A) |
| | 6:21636 | GJBX—136-81(Vol.2B) |
| **AC13-GJ01664** | **Stieff Research and Development Co., Inc., Kensington, MD (USA)** | |
| | 6:21640 | GJBX—144(81) |
| **AC14-76FF02170** | **Hanford Engineering Development Lab., Richland, WA (USA)** | |
| | 6:22027 | HEDL-TME—80-85 |
| | 6:22036 | HEDL-SA—2175 |
| | 6:22059 | HEDL-SA—2044 |
| | 6:22060 | HEDL-SA—2275-FP |
| | 6:22061 | HEDL-SA—2278-FP |
| | 6:22077 | HEDL-SA—2244-FP |
| | 6:22078 | HEDL-SA—2244-S |
| | 6:22912 | HEDL-SA—2253 |
| **AC15-76CL02395** | **Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.** | |
| | 6:22031 | CONF-810615—2 |
| | 6:22032 | CONF-810625—13 |
| | 6:22033 | CONF-810625—14 |
| | 6:22034 | CONF-810625—16 |
| | 6:22073 | CONF-810625—15 |
| **AC18-79FC10066** | **Energy Resources Co., Inc., Walnut Creek, CA (USA)** | |
| | 6:21487 | DOE/FC/10066—T1-(Vol.3) |
| | 6:21488 | DOE/FC/10066—T1(Vol.5) |
| | 6:21543 | DOE/FC/10066—T1(Vol.2) |
| | 6:21544 | DOE/FC/10066—T1(Vol.6) |
| | 6:21567 | DOE/FC/10066—T1(Vol.4) |
| **AC18-80FC10169** | **Energy Resources Co., Inc., Walnut Creek, CA (USA)** | |
| | 6:21556 | DOE/FC/10169—T1 |
| **AC18-80FC10182** | **Meteorology Research, Inc., Altadena, CA (USA)** | |
| | 6:22008 | DOE/FC/10182—T12 |
| **AC21-76ET10593** | **Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry** | |
| | 6:22414 | DOE/ET/10593—T1 |
| **AC21-76MC05204** | **Indiana Geological Survey, Bloomington (USA)** | |
| | 6:21599 | METC/EGSP—816 |
| **AC21-76MC08004** | **Illinois State Geological Survey, Urbana (USA)** | |
| | 6:21538 | DOE/MC/08004—T8 |
| **AC21-77ET10373** | **Combustion Power Co., Inc., Menlo Park, CA (USA)** | |
| | 6:21997 | DOE/ET/10373—T6 |
| **AC21-77ET10415** | **Minnick (L. John), Plymouth Meeting, PA (USA)** | |
| | 6:22240 | DOE/ET/10415—T3 |
| **AC21-78ET10484** | **Wormser Engineering, Inc., Middleton, MA (USA)** | |
| | 6:22459 | DOE/ET/10484—T2 |
| **AC21-80ET17091** | **General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.** | |
| | 6:22000 | DOE/ET/17091—T1 |
| **AC21-80MC14395** | **United Technologies Corp., South Windsor, CT (USA). Power Systems Div.** | |
| | 6:22161 | DOE/MC/14395—T1 |
| **AC21-81MC16230** | **Pope, Evans and Robbins, Inc., New York (USA)** | |
| | 6:22001 | DOE/MC/16230—152 |
| | 6:22002 | DOE/MC/16230—153 |
| | 6:22003 | DOE/MC/16230—156 |
| | 6:22006 | DOE/MC/16230—155 |
| | 6:22460 | DOE/MC/16230—154 |
| **AC22-76ET10532** | **Chevron Research Co., Richmond, CA (USA)** | |
| | 6:21493 | DOE/ET/10532—T1 |
| **AC22-77ET11313** | **Exxon Research and Engineering Co., Linden, NJ (USA)** | |
| | 6:21998 | DOE/ET/11313—1 |
| **AC22-78ET11429** | **Delaware Univ., Newark (USA). Dept. of Chemical Engineering** | |
| | 6:21494 | DOE/ET/11429—T1 |
| **AC22-79ET13395** | **Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering** | |
| | 6:21496 | DOE/ET/13395—T1 |
| **AC22-79ET14806** | **Air Products and Chemicals, Inc., Trexlertown, PA (USA)** | |
| | 6:21499 | DOE/ET/14806—T2 |
| | 6:21500 | DOE/ET/14806—T3 |
| **AC22-80PC30072** | **Rockwell International Corp., Thousand Oaks, CA (USA). Science Center** | |
| | 6:21503 | DOE/PC/30072—T3 |
| **AC22-80PC30198** | **Hercules, Inc., Cumberland, MD (USA). Hercules Aerospace Div.** | |
| | 6:21504 | DOE/PC/30198—T3 |
| | 6:21505 | DOE/PC/30198—T5 |
| | 6:21561 | DOE/PC/30198—T4 |
| **AC22-80PC30293** | **Physical Sciences, Inc., Woburn, MA (USA)** | |
| | 6:21562 | DOE/PC/30293—2 |
| **AI01-76CS31037** | **International Business Machines Corp., Huntsville, AL (USA). Federal Systems Div.** | |
| | 6:21854 | DOE/NASA/CR—161724 |
| | 6:21855 | DOE/NASA/CR—161725 |
| | 6:21856 | DOE/NASA/CR—161726 |
| | 6:21857 | DOE/NASA/CR—161728 |
| **AI01-76ET20320** | **National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center** | |
| | 6:21984 | DOE/NASA/20320—30 |
| **AI01-76ET20356** | **Jet Propulsion Lab., Pasadena, CA (USA)** | |
| | 6:21820 | DOE/ET/20356—2 |
| **AI01-76ET20485** | **National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center** | |
| | 6:21822 | DOE/NASA/20485—8 |
| **AI01-76PR06010** | **National Bureau of Standards, Washington, DC (USA). Center for Building Technology** | |
| | 6:21944 | NBS-TN—1134 |
| **AI01-77ET10769** | **National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center** | |
| | 6:22151 | DOE/NASA/10769—16 |
| **AI01-78CS54209** | **Jet Propulsion Lab., Pasadena, CA (USA)** | |
| | 6:22261 | DOE/CS/54209—2 |
| **AI01-79ET29372** | **General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.** | |
| | 6:22128 | DOE/JPL/955456—1(Vol.1) |
| | 6:22129 | DOE/JPL/955456—1(Vol.2) |
| | 6:22130 | DOE/JPL/955456—1(Vol.3) |
| | 6:22131 | DOE/JPL/955456—1(Vol.4) |
| | 6:22132 | DOE/JPL/955456—1(Vol.5) |
| **AI01-80ER10160** | **Department of Commerce, Boulder, CO (USA). Inst. for Telecommunication Sciences** | |
| | 6:21751 | DOE/ER/10160—T3 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| | 6:21752 | LA-UR—80-3095 |
| | 6:21812 | DOE/ER/10160—T4 |
| **AI02-79CH00135** | **Naval Coastal Systems Center, Panama City, FL (USA)** | |
| | 6:21841 | DOE/CH/00135—3 |
| **AI05-80OR20679** | **National Bureau of Standards, Washington, DC (USA). Center for Materials Science** | |
| | 6:22296 | DOE/OR/20679—T4 |
| **AI06-79ET23151** | **National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.** | |
| | 6:21983 | DOE/ET/23151—80/1 |
| **AI08-78ET44802** | **Geological Survey, Denver, CO (USA)** | |
| | 6:22722 | DOE/ET/44802—T1 |
| **AI08-79DP40094** | **National Bureau of Standards, Washington, DC (USA)** | |
| | 6:22305 | DOE/DP/40094—T1 |
| **AI09-80SR10702** | **Forest Service, Asheville, NC (USA). Southeastern Forest Experiment Station** | |
| | 6:22670 | DOE/SR/10702—1 |
| **AM01-76EI02295** | **Massachusetts Inst. of Tech., Cambridge (USA)** | |
| | 6:21651 | MIT-EL—80-014 |
| **AM02-76CH03023** | **Princeton Univ., NJ (USA). Plasma Physics Lab.** | |
| | 6:22918 | PPPL—1790 |
| **AM02-76CH03073** | **Princeton Univ., NJ (USA). Plasma Physics Lab.** | |
| | 6:22882 | PPPL—1774 |
| | 6:22883 | PPPL—1781 |
| | 6:22884 | PPPL—1783 |
| | 6:22885 | PPPL—1791 |
| | 6:22886 | PPPL—1792 |
| **AM21-78MC08216** | **Science Applications, Inc., Morgantown, WV (USA)** | |
| | 6:21597 | DOE/MC/08216—157 |
| **AS02-76CS32867** | **Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.** | |
| | 6:21852 | DOE/CS/32867—T1 |
| **AS02-76ET37241** | **Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering** | |
| | 6:22035 | DOE/ET/37241—45 |
| **AS02-76ET52040** | **Illinois Univ., Urbana (USA). Fusion Studies Lab.** | |
| | 6:22878 | DOE/ET/52040—T2 |
| **AS02-76EV02040** | **Chicago Univ., IL (USA)** | |
| | 6:22704 | DOE/EV/02040—T1 |
| **AS02-76EV02364** | **Oakland Univ., Rochester, MI (USA)** | |
| | 6:22673 | DOE/EV/02364—T1 |
| **AS02-76EV02472** | **Harvard Univ., Cambridge, MA (USA). Museum of Comparative Zoology** | |
| | 6:22637 | DOE/EV/02472—T1 |
| **AS02-76EV02737** | **New York Univ., NY (USA). Inst. of Environmental Medicine** | |
| | 6:22719 | DOE/EV/02737—9 |
| **AS02-77DP40012** | **Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies** | |
| | 6:22909 | DOE/DP/40012—T1 |
| **AS02-77ER04426** | **Illinois Univ., Chicago (USA)** | |
| | 6:22393 | DOE/ER/04426—4 |
| **AS02-77ET52039** | **McDonnell Douglas Astronautics Co., St. Louis, MO (USA)** | |
| | 6:22270 | DOE/ET/52039—2 |
| **AS02-78ER04634** | **Aspen Inst. for Humanistic Studies, Boulder, CO (USA)** | |
| | 6:22738 | DOE/ER/04634—1 |
| **AS02-78ER04974** | **Brown Univ., Providence, RI (USA)** | |
| | 6:22772 | DOE/ER/04974—T1 |
| **AS02-78ER05016** | **Brigham Young Univ., Provo, UT (USA). Thermochemical Inst.** | |
| | 6:22326 | DOE/ER/05016—3 |
| **AS02-79ER10438** | **City Coll., New York (USA). Dept. of Physics** | |
| | 6:22295 | DOE/ER/10438—T1 |
| **AS03-79CS30210** | **Oklahoma State Univ., Stillwater (USA). School of Technology** | |
| | 6:21847 | DOE/CS/30210—T1 |
| **AS05-76DP40017** | **Georgia Inst. of Tech., Atlanta (USA). School of Physics** | |
| | 6:22771 | DOE/DP/40017—T1 |
| **AS05-76ER03992** | **Texas Univ., Austin (USA). Center for Particle Theory** | |
| | 6:22823 | DOE/ER/03992—423 |
| **AS05-76ER04447** | **Tennessee Univ., Knoxville (USA)** | |
| | 6:22363 | DOE/ER/04447—124 |
| **AS05-76ET28388** | **Texas Univ., Austin (USA). Bureau of Economic Geology** | |
| | 6:21959 | DOE/ET/28388—T1 |
| **AS05-78ER05940** | **Maryland Univ., College Park (USA). Dept. of Physics and Astronomy** | |
| | 6:22467 | DOE/ER/05940—2 |
| **AS05-78ET20071** | **Puerto Rico Univ., Rio Piedras. Center for Energy and Environment Research** | |
| | 6:21761 | DOE/ET/20071—T4 |
| **AS05-78OR05951** | **Tennessee Univ., Knoxville (USA). Dept. of Chemical, Metallurgical and Polymer Engineering** | |
| | 6:22271 | DOE/OR/05951—T1 |
| **AS05-80ER10749** | **Arkansas Univ., Fayetteville (USA). Dept. of Physics** | |
| | 6:22773 | DOE/ER/10749—1 |
| **AS07-80CS40361** | **Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering** | |
| | 6:21490 | CONF-810473—1 |
| **AS08-77DP40003** | **Arizona Univ., Tucson (USA)** | |
| | 6:22905 | DOE/DP/40003—T1 |
| **AS08-78ET27087** | **Texas Univ., Austin (USA). Center for Energy Studies** | |
| | 6:21966 | DOE/ET/27087—T1 |
| **AS19-80BC10300** | **Oklahoma Univ., Norman (USA)** | |
| | 6:21569 | DOE/BC/10300—10 |
| **AS21-76MC05198** | **Pennsylvania Dept. of Environmental Resources, Harrisburg (USA). Bureau of Topographic and Geologic Survey** | |
| | 6:21598 | METC/EGSP—14 |
| **AS21-78ET12082** | **New Mexico Inst. of Mining and Technology, Socorro (USA)** | |
| | 6:21571 | DOE/ET/12082—9 |
| **AT01-76CS73015** | **AIA Research Corp., Washington, DC (USA)** | |
| | 6:22195 | DOE/TIC—11454 |
| | 6:22196 | DOE/TIC—11455 |
| | 6:22197 | DOE/TIC—11456 |
| | 6:22198 | DOE/TIC—11457 |
| | 6:22222 | DOE/TIC—11459 |
| **AT03-76EV72005** | **California Univ., Berkeley (USA). Dept. of Physics** | |
| | 6:22774 | DOE/EV/72005—T2 |
| **AT03-76SF70046** | **General Atomic Co., San Diego, CA (USA)** | |
| | 6:22049 | GA-A—16239 |
| | 6:22050 | GA-A—16262 |
| **FC01-78EI06278** | **Maine State Government, Augusta (USA)** | |
| | 6:21583 | DOE/EIA/06278—T1 |
| | 6:21584 | DOE/EIA/06278—T2 |
| **FC01-79EI10169** | **New Jersey Dept. of Energy, Newark (USA)** | |
| | 6:21585 | DOE/EIA/10169—T1 |
| **FC01-79EI10221** | **Connecticut State Government, Hartford (USA)** | |
| | 6:21586 | DOE/EIA/10221—T2 |
| **FC01-79EI10297** | **Rhode Island State Energy Office, Providence (USA)** | |
| | 6:21587 | DOE/EIA/10297—T1 |
| **FC02-79CS30278** | **Florida Solar Energy Center, Cape Canaveral (USA)** | |
| | 6:21736 | DOE/CS/30278—T4 |
| **FC02-80CS30367** | **Butler Mfg. Co., Kansas City, MO (USA)** | |
| | 6:21849 | DOE/CS/30367—4 |
| | 6:21850 | DOE/CS/30367—T1 |
| **FC03-78ET27163** | **WESTEC Services, Inc., Albuquerque, NM (USA)** | |
| | 6:21965 | DOE/ET/27163—2 |
| | 6:21970 | DOE/ET/27163—1 |
| **FC03-80RA50076** | **Arizona Solar Energy Research Commission, Phoenix (USA)** | |
| | 6:21955 | DOE/RA/50076—T3 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| **FC20-78LC10787** | **Geokinetics, Inc., Concord, CA (USA)** | |
| | 6:21608 | DOE/LC/10787—77 |
| **FG01-78CS60419** | **National Association of Counties Research, Inc., Washington, DC (USA). Energy Project** | |
| | 6:22248 | DOE/CS/60419—T1 |
| **FG01-79CS60467** | **Massachusetts Building Code Commission, Boston, MA (USA)** | |
| | 6:22191 | DOE/CE/60467—02 |
| **FG01-79EI10189** | **Stanford Univ., CA (USA). Inst. for Communication Research** | |
| | 6:21737 | DOE/EIA/10189—T1 |
| | 6:21738 | DOE/EIA/10189—T3 |
| | 6:21853 | DOE/EIA/10189—T2 |
| **FG01-79RA20222** | **Philadelphia Gas Works, PA (USA)** | |
| | 6:21508 | DOE/RA/20222—T1 |
| | 6:21509 | DOE/RA/20222—T2 |
| **FG01-80EV10335** | **National Academy of Sciences - National Research Council, Washington, DC (USA)** | |
| | 6:22558 | CONF-8009140— |
| **FG01-80EV10454** | **Florida International Univ., Miami (USA)** | |
| | 6:22104 | DOE/EV/10454—T1 |
| **FG02-78IR05106** | **Public Technology, Inc., Washington, DC (USA)** | |
| | 6:21821 | DOE/IR/05106—T24 |
| | 6:22226 | DOE/IR/05106—T23 |
| | 6:22249 | DOE/IR/05106—T6 |
| | 6:22250 | DOE/IR/05106—T8 |
| **FG02-79CS30169** | **Davis Alternative Technology Associates, CA (USA)** | |
| | 6:21846 | DOE/CS/30169—6 |
| **FG02-80ER10727** | **Ohio State Univ., Columbus (USA)** | |
| | 6:22058 | DOE/ER—10727 |
| **FG02-80R510216** | **City Water, Light and Power, Springfield, IL (USA)** | |
| | 6:21858 | DOE/R5/10216—T1 |
| **FG22-80PC30221** | **Texas A and M Univ., College Station (USA)** | |
| | 6:21506 | DOE/PC/30221—T1 |
| **FG22-80PC30227** | **North Dakota Univ., Grand Forks (USA)** | |
| | 6:21507 | DOE/PC/30227—T1 |
| **FG22-80PC30303** | **California Univ., Irvine (USA). Dept. of Mechanical Engineering** | |
| | 6:22441 | DOE/PC/30303—T2 |
| **NAS-7-100-954334** | **Union Carbide Corp., Sistersville, WV (USA)** | |
| | 6:21765 | DOE/JPL/954334—18 |
| **NAS-7-100-954739** | **Rockwell International Corp., Thousand Oaks, CA (USA). Science Center** | |
| | 6:21766 | DOE/JPL/954739—4 |
| **NAS-7-100-954796** | **Pennsylvania Univ., Philadelphia (USA). Moore School of Electrical Engineering** | |
| | 6:21767 | DOE/JPL/954796—81/12 |
| **NAS-7-100-955089** | **Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.** | |
| | 6:21768 | DOE/JPL/955089—80/10 |
| **NAS-7-100-955533** | **Hemlock Semiconductor Corp., MI (USA)** | |
| | 6:21769 | DOE/JPL/955533—81/5 |
| **NAS-7-100-955699** | **Tracor MBA, San Ramon, CA (USA)** | |
| | 6:21770 | DOE/JPL/955699—81/03 |
| **NAS-7-100-955733** | **Kayex Corp., Rochester, NY (USA)** | |
| | 6:21771 | DOE/JPL/955733—80/1 |
| **W-31-109-ENG-38** | **Argonne National Lab., IL (USA)** | |
| | 6:21540 | ANL/EES-TM—130 |
| | 6:21811 | DOE/ER—0099 |
| | 6:21936 | ANL/EES-TM—135 |
| | 6:22066 | ANL/TMC—80-3 |
| | 6:22100 | ANL/CNSV—19 |
| | 6:22142 | ANL/MHD—80-8 |
| | 6:22143 | ANL/MHD—81-5 |
| | 6:22535 | ANL/EES-TM—129 |
| | 6:22723 | DOE/RG—0059 |
| | 6:22748 | ANL—80-126 |
| **W-7405-ENG-26** | **Oak Ridge National Lab., TN (USA)** | |
| | 6:21513 | ORNL/FMP—81/1 |
| | 6:21514 | ORNL/MIT—326 |
| | 6:21515 | ORNL/TM—7533 |
| | 6:21539 | ORNL/MIT—327 |
| | 6:21619 | CONF-791016— |
| | 6:21641 | GJBX—145(81) |
| | 6:21643 | ORNL-tr—4735 |
| | 6:21693 | CONF-810548—3 |
| | 6:21758 | CONF-810526—26(Draft) |
| | 6:21759 | CONF-810526—27 |
| | 6:21760 | CONF-810526—28(Draft) |
| | 6:21992 | CONF-810567—1 |
| | 6:22007 | CONF-810545—2 |
| | 6:22038 | ORNL—5711 |
| | 6:22039 | ORNL/TM—7714 |
| | 6:22040 | ORNL/TM—7715 |
| | 6:22065 | ORNL/TM—7819 |
| | 6:22072 | CONF-810553—1 |
| | 6:22088 | ORNL/TM—7779 |
| | 6:22099 | ORNL/CSD/TM—141 |
| | 6:22112 | CONF-810140—1 |
| | 6:22120 | ORNL—5746 |
| | 6:22121 | ORNL/TM—7199 |
| | 6:22209 | ORNL/Sub—81/13800/1 |
| | 6:22210 | ORNL/Sub—7715/4 |
| | 6:22230 | CONF-8003114— |
| | 6:22247 | CONF-810565—1 |
| | 6:22332 | ORNL—5738 |
| | 6:22506 | ANL-Trans—1195 |
| | 6:22538 | CONF-801045— |
| | 6:22557 | CONF-810531—1 |
| | 6:22595 | ORNL/EIS—192/V2 |
| | 6:22596 | ORNL/EIS—192/V4 |
| | 6:22597 | EPA—570/9-81-001(Vol.1) |
| | 6:22648 | CONF-810554—1 |
| | 6:22702 | CONF-800323—4 |
| | 6:22769 | CONF-810432—3 |
| **W-7405-ENG-36** | **Los Alamos Scientific Lab., NM (USA)** | |
| | 6:21607 | LA—8397-PR |
| | 6:21609 | LA—8744-MS |
| | 6:21616 | LA-UR—81-1196 |
| | 6:21672 | LA-UR—81-1385 |
| | 6:21691 | LA—8811-PR |
| | 6:21694 | LA—8809-MS |
| | 6:21695 | LA-UR—81-1402 |
| | 6:21696 | LA-UR—81-1510 |
| | 6:21697 | LA-UR—81-1512 |
| | 6:21746 | LA-UR—81-1201 |
| | 6:21862 | LA-UR—81-1039 |
| | 6:21956 | LA—8801-MS |
| | 6:21961 | LA-UR—81-1092 |
| | 6:21972 | LA-UR—81-1430 |
| | 6:22043 | LA—8797-PR |
| | 6:22080 | LA-UR—81-317 |
| | 6:22205 | LA—8295-MS |
| | 6:22227 | LA-UR—81-813 |
| | 6:22273 | LA-UR—81-1400 |
| | 6:22312 | LA-UR—81-1443 |
| | 6:22328 | LA-UR—81-1511 |
| | 6:22329 | LA-UR—81-1526 |
| | 6:22330 | LA-UR—1461 |
| | 6:22418 | DOE/TIC—1022096 |
| | 6:22420 | LA-UR—81-1038 |
| | 6:22421 | LA-UR—81-1084 |
| | 6:22422 | LA-UR—81-1316 |
| | 6:22423 | LA-UR—81-1643 |
| | 6:22429 | UCRL—84875(Rev.1) |
| | 6:22430 | UCRL—84876(Rev.1) |
| | 6:22434 | LA-UR—81-1232 |
| | 6:22435 | LA-UR—81-1565 |
| | 6:22436 | LA-UR—81-1567 |
| | 6:22480 | LA-tr—80-10 |
| | 6:22485 | LA-UR—81-1324 |
| | 6:22486 | LA-UR—81-1640 |
| | 6:22519 | LA-UR—81-1074 |
| | 6:22520 | LA-UR—81-1126 |
| | 6:22522 | LA-UR—81-992 |
| | 6:22523 | LA-UR—81-1067 |
| | 6:22524 | LA-UR—81-1270 |
| | 6:22556 | LA-UR—81-1175 |
| | 6:22705 | LA-UR—81-1166 |
| | 6:22739 | LA-UR—81-965 |
| | 6:22740 | LA-UR—81-966 |
| | 6:22775 | LA-UR—81-1157 |
| | 6:22776 | LA-UR—81-1228 |
| | 6:22854 | LA-UR—81-1555 |
| | 6:22860 | LA—8799-MS |
| | 6:22879 | LA-UR—81-1028 |
| | 6:22880 | LA-UR—81-1148 |
| | 6:22881 | LA-UR—81-1435 |
| | 6:22913 | LA-UR—81-1229 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| | 6:22914 | LA-UR—81-1245 |
| | 6:22915 | LA-UR—81-1394 |
| | 6:22916 | LA-UR—81-1404 |
| | 6:22917 | LA-UR—81-1408 |
| | 6:22974 | LA-UR—81-1082 |
| | 6:22975 | LA-UR—81-1192 |
| **W-7405-ENG-48** | **Lawrence Livermore National Lab., CA (USA)** | |
| | 6:21517 | UCRL—50026-80-4 |
| | 6:21596 | LBL—12128 |
| | 6:21605 | UCRL—85331(Rev.1) |
| | 6:21611 | UCID—19045 |
| | 6:21612 | UCRL—85845 |
| | 6:21615 | LBL—11214 |
| | 6:21617 | LBL—11197 |
| | 6:21673 | LBL—12478 |
| | 6:21686 | UCID—19034 |
| | 6:21719 | UCRL—84475(Rev.1) |
| | 6:21720 | UCRL—85140 |
| | 6:21722 | UCRL—85743 |
| | 6:21727 | LBL—12146 |
| | 6:21731 | UCRL—85409 |
| | 6:21877 | UCID—18893 |
| | 6:21960 | LBL—12174 |
| | 6:21967 | LBL—11940 |
| | 6:21968 | LBL—12175 |
| | 6:21969 | LBL—12392 |
| | 6:22028 | UCI—18966 |
| | 6:22082 | UCRL—15345 |
| | 6:22083 | UCRL—85707 |
| | 6:22087 | UCRL—84347 |
| | 6:22090 | LBL—12102 |
| | 6:22091 | LBL—12445 |
| | 6:22092 | LBL—12514 |
| | 6:22206 | LBL—11701 |
| | 6:22264 | LBL—12548 |
| | 6:22265 | UCID—19029 |
| | 6:22306 | UCRL—52434(Vol.8) |
| | 6:22364 | LBL—12127 |
| | 6:22394 | UCID—18509-80-1 |
| | 6:22415 | LBL—12141 |
| | 6:22416 | LBL—12214 |
| | 6:22428 | UCID—19049 |
| | 6:22429 | UCRL—84875(Rev.1) |
| | 6:22430 | UCRL—84876(Rev.1) |
| | 6:22431 | UCRL—84968 |
| | 6:22432 | UCRL—85016 |
| | 6:22443 | UCRL—84691 |
| | 6:22444 | UCRL—85337 |
| | 6:22445 | UCRL—85354 |
| | 6:22446 | UCRL—85366 |
| | 6:22448 | UCRL—85254 |
| | 6:22457 | UCRL—83992 |
| | 6:22463 | UCID—18286 |
| | 6:22465 | LBL—12215 |
| | 6:22468 | LBL—11580 |
| | 6:22469 | LBL—11726 |
| | 6:22487 | LBL—11709 |
| | 6:22488 | LBL—11713 |
| | 6:22489 | LBL—11715 |
| | 6:22490 | LBL—11719 |
| | 6:22491 | LBL—11725 |
| | 6:22492 | LBL—12552 |
| | 6:22505 | UCRL—83993 |
| | 6:22527 | UCRL—15334 |
| | 6:22529 | UCRL—52934 |
| | 6:22530 | UCRL—85730 |
| | 6:22532 | LBL—12540 |
| | 6:22533 | UCRL—85958 |
| | 6:22546 | LBL—12539 |
| | 6:22547 | UCID—19040 |
| | 6:22630 | CONF-8005164—1 |
| | 6:22694 | LBL—12555 |
| | 6:22726 | UCRL—85411 |
| | 6:22730 | LBL—12511 |
| | 6:22732 | UCID—19047 |
| | 6:22777 | LBL—12157 |
| | 6:22786 | LBL—12626 |
| | 6:22788 | UCRL—15327 |
| | 6:22789 | UCRL—83764 |
| | 6:22790 | UCRL—85577 |
| | 6:22791 | UCRL—85577(Rev.1) |
| | 6:22792 | UCRL—85858 |
| | 6:22844 | LBL—11588 |
| | 6:22859 | UCID—19055 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| | 6:22866 | UCID—19024 |
| | 6:22887 | UCAR—10060-80-3 |
| | 6:22888 | UCRL—53099 |
| | 6:22919 | UCID—18983 |
| | 6:22920 | UCRL—52000-81-6 |
| | 6:22978 | UCID—18649 |
| | 6:22979 | UCID—30183 |
| | 6:22980 | UCRL—15346 |
| | 6:22981 | UCRL—83791(Rev.1) |
| | 6:22982 | UCRL—84964 |
| | 6:22983 | UCRL—84965 |
| | 6:22984 | UCRL—84966 |
| | 6:22985 | UCRL—85310 |
| | 6:22990 | LBL—12350 |

# REPORT NUMBER INDEX

The numbers assigned to all reports cited in the publication appear in the first column of the index. The citation numbers are included in the second column. Cross reference information and/or availability are included as appropriate. Abbreviations used in the availability column are elaborated at the end of the index. To expedite the filling of orders for reports from NTIS and TIC, an Order Number in the form, DE81000001, is appended to the availability statement. Requesters are urged to use this Order Number where provided. Following the Order Number, one or more DOE distribution categories are indicated, e.g. , UC-10, UC-25. These category numbers are included to assist DOE librarians in responding to requests for reports in their collections. The UC (Unclassified Distribution Categories) are defined in DOE/TIC-4500, available from TIC.

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **ALO-** | | |
| 137 | 6:22025 | NTIS, PC A10/MF A01 |
| **ANL-** | | |
| 80-126 | 6:22748 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22749 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22750 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22751 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22752 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22753 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22754 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22755 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22756 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22757 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22758 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22759 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22760 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22761 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22762 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22763 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22764 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22765 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22766 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22767 | NTIS, PC A14/MF A01 |
| 80-126 | 6:22768 | NTIS, PC A14/MF A01 |
| **ANL/CNSV-** | | |
| 19 | 6:22100 | NTIS, PC A04/MF A01 |
| **ANL/EES-TM-** | | |
| 129 | 6:22535 | NTIS, PC A13/MF A01 |
| 130 | 6:21540 | NTIS, PC A05/MF A01 |
| 130 | 6:21541 | NTIS, PC A05/MF A01 |
| 130 | 6:22229 | NTIS, PC A05/MF A01 |
| 130 | 6:22464 | NTIS, PC A05/MF A01 |
| 130 | 6:22536 | NTIS, PC A05/MF A01 |
| 130 | 6:22537 | NTIS, PC A05/MF A01 |
| 130 | 6:22553 | NTIS, PC A05/MF A01 |
| 135 | 6:21936 | NTIS, PC A03/MF A01 |
| **ANL/MHD-** | | |
| 80-8 | 6:22142 | NTIS, PC A03/MF A01 |
| 81-5 | 6:22143 | NTIS, PC A04/MF A01 |
| **ANL/TMC-** | | |
| 80-3 | 6:22066 | NTIS, PC A08/MF A01 |
| **ANL-Trans-** | | |
| 1195 | 6:22506 | NTIS, PC A05/MF A01 |
| **BDX-** | | |
| 613-2620 | 6:22417 | NTIS, PC A02/MF A01. Order Number DE81023772 |
| **BNL-** | | |
| 29243 | 6:22481 | NTIS, PC A02/MF A01 |
| 29440 | 6:22736 | NTIS, PC A02/MF A01 |
| 29465 | 6:22817 | NTIS, PC A03/MF A01 |
| 29468 | 6:22822 | NTIS, PC A02/MF A01 |
| 29480 | 6:22169 | NTIS, PC A02/MF A01 |
| 29527 | 6:22737 | NTIS, PC A02/MF A01 |
| 29546 | 6:22834 | NTIS, PC A02/MF A01 |
| **BNL-NCS-** | | |
| 29035 | 6:22858 | NTIS, PC A03/MF A01 |
| 51354 | 6:22843 | *See* DOE/NDC-22/U |
| **CAPE-** | | |
| 2689 | 6:22433 | EM |
| 2690 | 6:22509 | EM |
| 2694 | 6:22966 | EM |
| **CEND-** | | |
| 384 | 6:22046 | *See* DOE/ET/34013-T1 |
| **CONF-771102-** | | (70. annual AICHE meeting, New York, NY, USA, 13-17 Nov 1977) |
| | 6:22910 | AIChE Symp. Ser., 75: No. 191, 196-200(1977) |
| **CONF-790114-** | | (Conference on energy alternatives, Honolulu, HI, USA, 9-12 Jan 1979) |
| | 6:21933 | Energy (Oxford), 4: No. 5, 769-774(Oct 1979) |
| **CONF-790145-** | | (Meeting on erosion-corrosion of materials in coal conversion systems, Berkeley, CA, USA, 24-26 Jan 1979) |
| 4 | 6:21991 | NTIS, PC A02/MF A01 |
| **CONF-790418-** | | (Scanning electron microscopy conference, Washington, DC, USA, 16-20 Apr 1979) |
| | 6:22964 | SPIE Semin. Proc., 179: 61-66(1979) |
| | 6:22965 | SPIE Semin. Proc., 179: 67-74(1979) |
| **CONF-790442-** | | (International conference on metallurgical coatings, San Diego, CA, USA, 23-27 Apr 1979) |
| | 6:21807 | Thin Solid Films, 63: No. 1, 203-211(Apr 1979) |
| | 6:22029 | Thin Solid Films, 64: No. 2, 271-280(Apr 1979) |
| | 6:22952 | J. Nucl. Mater., 88: No. 1, 168-173(Jan 1980) |
| | 6:22955 | Thin Solid Films, 63: No. 2, 213-226(Apr 1979) |
| | 6:22956 | Thin Solid Films, 63: No. 2, 283-288(Apr 1979) |
| | 6:22957 | Thin Solid Films, 63: No. 2, 243-249(Apr 1979) |
| | 6:22958 | Thin Solid Films, 63: No. 2, 251-256(Apr 1979) |
| | 6:22959 | Thin Solid Films, 63: No. 2, 257-261(Apr 1979) |
| | 6:22960 | Thin Solid Films, 63: No. 2, 269-275(Apr 1979) |
| | 6:22963 | Thin Solid Films, 63: No. 2, 277-281(1979) |
| **CONF-790443-** | | (American power conference, Chicago, IL, USA, 23-25 Apr 1979) |
| | 6:22110 | Proc. Am. Power Conf., 41: 793-799(1979) |
| **CONF-7908145-** | | (Workshop on biotransformation and fate of chemicals in the aquatic environment, Pellston, MI, USA, 14-18 Aug 1979) |
| | 6:22582 | Washington, DC; American Society for Microbiology (1980). |
| **CONF-790917-** | | (American Chemical Society national meeting, Washington, DC, USA, 10-14 Sep 1979) |
| P4 | 6:22292 | ACS Symp. Ser., No. 131, 199-220(1980) |
| P4 | 6:22376 | Washington, DC; American Chemical Society (1980). |
| P4 | 6:22377 | ACS Symp. Ser., No. 131, 275-311(1980) |
| P4 | 6:22378 | ACS Symp. Ser., No. 131, 349-368(1980) |
| P4 | 6:22411 | ACS Symp. Ser., No. 131, 93-140(1980) |
| P4 | 6:22412 | ACS Symp. Ser., No. 131, 221-238(1980) |
| P4 | 6:22413 | ACS Symp. Ser., No. 131, 239-263(1980) |
| P4 | 6:22698 | ACS Symp. Ser., No. 131, 143-172(1980) |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| P4 | 6:22811 | ACS Symp. Ser., No. 131, 381-425(1980) |
| **CONF-7909201-** | (Symposium on power and measurement transformers, Positano, Italy, 11-13 Sep 1979) | |
| | 6:22009 | NTIS (US Sales Only), PC A15/MF A01 |
| **CONF-791016-** | (1979 DOE statistical symposium, Gatlinburg, TN, USA, 24-26 Oct 1979) | |
| | 6:21568 | NTIS, PC A11/MF A01 |
| | 6:21618 | NTIS, PC A11/MF A01 |
| | 6:21619 | NTIS, PC A11/MF A01 |
| | 6:21652 | NTIS, PC A11/MF A01 |
| | 6:22067 | NTIS, PC A11/MF A01 |
| | 6:22068 | NTIS, PC A11/MF A01 |
| | 6:22069 | NTIS, PC A11/MF A01 |
| | 6:22070 | NTIS, PC A11/MF A01 |
| | 6:22098 | NTIS, PC A11/MF A01 |
| | 6:22105 | NTIS, PC A11/MF A01 |
| | 6:22163 | NTIS, PC A11/MF A01 |
| | 6:22969 | NTIS, PC A11/MF A01 |
| | 6:22970 | NTIS, PC A11/MF A01 |
| **CONF-791069-** | (6. annual conference on energy, Rolla, MO, USA, 16-18 Oct 1979) | |
| | 6:22086 | Annu. UMR-DNR Conf. Energy, [Proc.], 448-457(1979) |
| **CONF-791077-** | (Workshop on measurement and interpretation of actinide accumulation by man, Snowbird, UT, USA, 14-18 Oct 1979) | |
| 8 | 6:22556 | *See* LA-UR-81-1175 |
| **CONF-7910107-** | (IEEE-IAS conference on "electrostatics", Cleveland, OH, USA, 1-4 Oct 1979) | |
| | 6:22262 | Conf. Rec., IAS Annu. Meet., No. 79CH1484-51A, 421-428(1979) |
| | 6:22961 | Conf. Rec., IAS Annu. Meet., No. 79CH1484-51A, 472-478(1979) |
| | 6:22962 | Conf. Rec., IAS Annu. Meet., No. 79CH1484-51A, 817-823(1979) |
| **CONF-7910117-** | (Coal conference and EXPO V, Louisville, KY, USA, 23-25 Oct 1979) | |
| (Vol.2) | 6:21566 | New York, NY; McGraw-Hill, Inc. (1979). |
| **CONF-7910226-** | (2. international conference on automotive electronics, London, UK, 29 Oct-2 Nov 1979) | |
| | 6:22263 | Society of Automotive Engineers, Inc., Warrendale, PA |
| **CONF-791117-** | (ANS topical conference, Kiawah Island, SC, USA, 26 Nov 1979,-19 Nov 1979/REPLACES CONF-791180) | |
| | 6:21646 | Natl. Bur. Stand. (U.S.), Spec. Publ., 447-456(Jun 1980) |
| | 6:21647 | Natl. Bur. Stand. (U.S.), Spec. Publ., 584-601(Jun 1980) |
| | 6:21689 | Natl. Bur. Stand. (U.S.), Spec. Publ., 622-632(Jun 1980) |
| | 6:21690 | Natl. Bur. Stand. (U.S.), Spec. Publ., 472-496(Jun 1980) |
| | 6:21699 | Natl. Bur. Stand. (U.S.), Spec. Publ., 261-275(Jun 1980) |
| | 6:21700 | Natl. Bur. Stand. (U.S.), Spec. Publ., vp(Jun 1980) |
| | 6:21701 | Natl. Bur. Stand. (U.S.), Spec. Publ., 1-14(Jun 1980) |
| | 6:21702 | Natl. Bur. Stand. (U.S.), Spec. Publ., 25-33(Jun 1980) |
| | 6:21703 | Natl. Bur. Stand. (U.S.), Spec. Publ., 66-78(Jun 1980) |
| | 6:21704 | Natl. Bur. Stand. (U.S.), Spec. Publ., 178-188(Jun 1980) |
| | 6:21705 | Natl. Bur. Stand. (U.S.), Spec. Publ., 257-260(Jun 1980) |
| | 6:21706 | Natl. Bur. Stand. (U.S.), Spec. Publ., 276-307(Jun 1980) |
| | 6:21707 | Natl. Bur. Stand. (U.S.), Spec. Publ., 308-312(Jun 1980) |
| | 6:21708 | Natl. Bur. Stand. (U.S.), Spec. Publ., 342-364(Jun 1980) |
| | 6:21709 | Natl. Bur. Stand. (U.S.), Spec. Publ., 365-371(Jun 1980) |
| | 6:21710 | Natl. Bur. Stand. (U.S.), Spec. Publ., 372-390(Jun 1980) |
| | 6:21711 | Natl. Bur. Stand. (U.S.), Spec. Publ., 555-567(Jun 1980) |
| | 6:21712 | Natl. Bur. Stand. (U.S.), Spec. Publ., 568-583(Jun 1980) |
| | 6:21713 | Natl. Bur. Stand. (U.S.), Spec. Publ., 651-669(Jun 1980) |
| | 6:21714 | Natl. Bur. Stand. (U.S.), Spec. Publ., 670-676(Jun 1980) |
| | 6:21715 | Natl. Bur. Stand. (U.S.), Spec. Publ., 718-729(Jun 1980) |
| | 6:21716 | Natl. Bur. Stand. (U.S.), Spec. Publ., 426-446(Jun 1980) |
| | 6:21717 | Natl. Bur. Stand. (U.S.), Spec. Publ., 391-425(Jun 1980) |
| | 6:21718 | Natl. Bur. Stand. (U.S.), Spec. Publ., 129-139(Jun 1980) |
| | 6:22064 | Natl. Bur. Stand. (U.S.), Spec. Publ., 313-323(Jun 1980) |
| | 6:22350 | Natl. Bur. Stand. (U.S.), Spec. Publ., 324-341(Jun 1980) |
| | 6:22351 | Natl. Bur. Stand. (U.S.), Spec. Publ., 602-616(Jun 1980) |
| | 6:22352 | Natl. Bur. Stand. (U.S.), Spec. Publ., 140-146(Jun 1980) |
| | 6:22353 | Natl. Bur. Stand. (U.S.), Spec. Publ., 164-168(Jun 1980) |
| | 6:22354 | Natl. Bur. Stand. (U.S.), Spec. Publ., 547-554(Jun 1980) |
| | 6:22355 | Natl. Bur. Stand. (U.S.), Spec. Publ., 103-110(Jun 1980) |
| | 6:22356 | Natl. Bur. Stand. (U.S.), Spec. Publ., 121-128(Jun 1980) |
| | 6:22357 | Natl. Bur. Stand. (U.S.), Spec. Publ., 147-155(Jun 1980) |
| | 6:22358 | Natl. Bur. Stand. (U.S.), Spec. Publ., 538-546(Jun 1980) |
| | 6:22359 | Natl. Bur. Stand. (U.S.), Spec. Publ., 156-163(Jun 1980) |
| | 6:22516 | Natl. Bur. Stand. (U.S.), Spec. Publ., 111-120(Jun 1980) |
| | 6:22517 | Natl. Bur. Stand. (U.S.), Spec. Publ., 633-650(Jun 1980) |
| **CONF-7911104-** | (Facility decontamination technology workshop, Hershey, PA, USA, 27-29 Nov 1979) | |
| | 6:22075 | *See* GEND-002 |
| **CONF-791222-** | (18. IEEE conference on decision and control, Fort Lauderdale, FL, USA, 12-14 Dec 1979) | |
| | 6:21934 | Proc. IEEE Conf. Decis. Control, 2: 917-919(1979) |
| | 6:22018 | Proc. IEEE Conf. Decis. Control, 2: 703-714(1979) |
| | 6:22019 | Proc. IEEE Conf. Decis. Control, 1: 264-269(1979) |
| | 6:22020 | Proc. IEEE Conf. Decis. Control, 1: 270-272(1979) |
| | 6:22021 | Proc. IEEE Conf. Decis. Control, 2: 697-702(1979) |
| | 6:22022 | Proc. IEEE Conf. Decis. Control, 2: 886-896(1979) |
| | 6:22024 | Proc. IEEE Conf. Decis. Control, 2: 802-805(1979) |
| | 6:22221 | Proc. IEEE Conf. Decis. Control, 2: 911-916(1979) |
| **CONF-800246-** | (Forest Products Research Society: Energy from forest products, Atlanta, GA, USA, Feb 1980) | |
| | 6:21734 | Madison, WI; Forest Products Research Society (1980). |
| **CONF-800323-** | (Symposium on the application of short-term bioassays in the fractionation and analysis of complex environmental mixtures, Williamsburg, VA, USA, 21-24 Mar 1980) | |
| 4 | 6:22702 | NTIS, PC A02/MF A01 |
| **CONF-8003114-** | (Energy conservation in design for UCCND managers and specialists meeting, Oak Ridge, TN, USA, 18-19 Mar 1980) | |
| | 6:21491 | NTIS, PC A20/MF A01 |
| | 6:21993 | NTIS, PC A20/MF A01 |
| | 6:22096 | NTIS, PC A20/MF A01 |
| | 6:22113 | NTIS, PC A20/MF A01 |
| | 6:22114 | NTIS, PC A20/MF A01 |
| | 6:22115 | NTIS, PC A20/MF A01 |
| | 6:22116 | NTIS, PC A20/MF A01 |
| | 6:22164 | NTIS, PC A20/MF A01 |
| | 6:22165 | NTIS, PC A20/MF A01 |
| | 6:22170 | NTIS, PC A20/MF A01 |
| | 6:22171 | NTIS, PC A20/MF A01 |
| | 6:22172 | NTIS, PC A20/MF A01 |
| | 6:22173 | NTIS, PC A20/MF A01 |
| | 6:22174 | NTIS, PC A20/MF A01 |
| | 6:22175 | NTIS, PC A20/MF A01 |
| | 6:22176 | NTIS, PC A20/MF A01 |
| | 6:22177 | NTIS, PC A20/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| | 6:22230 | NTIS, PC A20/MF A01 |
| | 6:22231 | NTIS, PC A20/MF A01 |
| | 6:22232 | NTIS, PC A20/MF A01 |
| | 6:22233 | NTIS, PC A20/MF A01 |
| | 6:22234 | NTIS, PC A20/MF A01 |
| | 6:22235 | NTIS, PC A20/MF A01 |
| | 6:22236 | NTIS, PC A20/MF A01 |
| | 6:22237 | NTIS, PC A20/MF A01 |
| CONF-800569- | (Spring conference on applied optics, Oakland, CA, USA, 31 May-6 Jun 1980) | |
| 2 | 6:22431 | *See* UCRL-84968 |
| CONF-8005107- | (Alternate waste form information workshop, Gatlinburg, TN, USA, 13-15 May 1980) | |
| | 6:21644 | NTIS, PC A17/MF A01 |
| | 6:21653 | NTIS, PC A17/MF A01 |
| | 6:21654 | NTIS, PC A17/MF A01 |
| | 6:21655 | NTIS, PC A17/MF A01 |
| | 6:21656 | NTIS, PC A17/MF A01 |
| | 6:21657 | NTIS, PC A17/MF A01 |
| | 6:21658 | NTIS, PC A17/MF A01 |
| | 6:21659 | NTIS, PC A17/MF A01 |
| | 6:21660 | NTIS, PC A17/MF A01 |
| | 6:21661 | NTIS, PC A17/MF A01 |
| | 6:21662 | NTIS, PC A17/MF A01 |
| | 6:21663 | NTIS, PC A17/MF A01 |
| | 6:21664 | NTIS, PC A17/MF A01 |
| | 6:22294 | NTIS, PC A17/MF A01 |
| CONF-8005162- | (Workshop on electron-atom and electron-molecule collisions, Bielefeld, F.R. Germany, 5-15 May 1980) | |
| 1 | 6:22792 | *See* UCRL-85858 |
| CONF-8005164- | (3. international conference on automation of diagnostic cytology and cell image analysis, Munich, F.R. Germany, 23-24 May 1980) | |
| 1 | 6:22630 | NTIS, PC A03/MF A01 |
| CONF-800604- | (American section of the International Solar Energy Society conference, Phoenix, AZ, USA, 2-6 Jun 1980) | |
| P3 | 6:21740 | NTIS, PC A99/MF A01 |
| P3 | 6:21742 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1104-1108(1980) |
| P3 | 6:21743 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1410-1414(1980) |
| P3 | 6:21744 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1415-1419(1980) |
| P3 | 6:21745 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1429-1433(1980) |
| P3 | 6:21748 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1231-1235(1980) |
| P3 | 6:21749 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1252-1256(1980) |
| P3 | 6:21754 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1188-1192(1980) |
| P3 | 6:21755 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1257-1261(1980) |
| P3 | 6:21756 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1298-1302(1980) |
| P3 | 6:21757 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1347-1351(1980) |
| P3 | 6:21801 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 986-990(1980) |
| P3 | 6:21802 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 991-995(1980) |
| P3 | 6:21803 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 996-999(1980) |
| P3 | 6:21804 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1047-1051(1980) |
| P3 | 6:21825 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1000-1006(1980) |
| P3 | 6:21826 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1021-1025(1980) |
| P3 | 6:21827 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1052-1054(1980) |
| P3 | 6:21828 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1055-1059(1980) |
| P3 | 6:21829 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1060-1066(1980) |
| P3 | 6:21830 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1091-1097(1980) |
| P3 | 6:21831 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1098-1103(1980) |
| P3 | 6:21832 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1109-1113(1980) |
| P3 | 6:21833 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1114-1117(1980) |
| P3 | 6:21834 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1136-1140(1980) |
| P3 | 6:21835 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1225(1980) |
| P3 | 6:21836 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1401-1405(1980) |
| P3 | 6:21917 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 779-783(1980) |
| P3 | 6:21918 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 789-793(1980) |
| P3 | 6:21919 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 794-798(1980) |
| P3 | 6:21920 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 808-815(1980) |
| P3 | 6:21921 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 821-825(1980) |
| P3 | 6:21922 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 831-835(1980) |
| P3 | 6:21923 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 836-840(1980) |
| P3 | 6:21924 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 855-859(1980) |
| P3 | 6:21925 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 865-869(1980) |
| P3 | 6:21926 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 875-878(1980) |
| P3 | 6:21927 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 879-883(1980) |
| P3 | 6:21928 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 884-888(1980) |
| P3 | 6:21929 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 918-922(1980) |
| P3 | 6:21930 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 947-951(1980) |
| P3 | 6:21931 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1220-1224(1980) |
| P3 | 6:21932 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1309-1313(1980) |
| P3 | 6:21952 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 971-980(1980) |
| P3 | 6:21953 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 908-912(1980) |
| P3 | 6:21979 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1486-1492(1980) |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| P3 | 6:21981 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1452-1458(1980) |
| P3 | 6:21982 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1468-1472(1980) |
| P3 | 6:22218 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 952-956(1980) |
| P3 | 6:22219 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 3.2: 1303-1307(1980) |
| **CONF-800614-** | (11. international quantum electronics conference, Boston, MA, USA, 23-26 Jun 1980) | |
| 4 | 6:22789 | *See* UCRL-83764 |
| **CONF-800622-** | (17. design automation conference, Minneapolis, MN, USA, 23-25 Jun 1980) | |
| 2(Rev.1) | 6:22981 | *See* UCRL-83791(Rev.1) |
| **CONF-800640-** | (14. pulse power modulator symposium, Orlando, FL, USA, 3-5 Jun 1980) | |
| 20 | 6:22457 | *See* UCRL-83992 |
| 21 | 6:22505 | *See* UCRL-83993 |
| **CONF-8006126-** | (9. international colloquium on group theoretical methods in physics, Mexico City, Mexico, Jun 1980) | |
| | 6:22876 | Schenectady, NY; American Institute of Physics (1980). |
| **CONF-8006166-** | (Workshop on design automation and computer aided design, Livermore, CA, USA, 10-11 Jun 1980) | |
| | 6:22978 | *See* UCID-18649 |
| **CONF-800726-** | (MCHF workshop, College Station, TX, USA, 14-16 Jul 1980) | |
| | 6:22777 | *See* LBL-12157 |
| | 6:22778 | *See* LBL-12157 |
| | 6:22779 | *See* LBL-12157 |
| | 6:22780 | *See* LBL-12157 |
| | 6:22781 | *See* LBL-12157 |
| | 6:22782 | *See* LBL-12157 |
| | 6:22783 | *See* LBL-12157 |
| | 6:22784 | *See* LBL-12157 |
| | 6:22785 | *See* LBL-12157 |
| **CONF-800735-** | (Healthy Physics Society summer school, Seattle, WA, USA, 14-18 Jul 1980) | |
| 3 | 6:22059 | *See* HEDL-SA-2044 |
| **CONF-800822-** | (Oil shale: the environmental challenges conference, Vail, CO, USA, 11 Aug 1980) | |
| 3 | 6:21615 | *See* LBL-11214 |
| 4 | 6:22705 | *See* LA-UR-81-1166 |
| 5 | 6:21617 | *See* LBL-11197 |
| **CONF-8008103-** | (Worldwide furbearer conference, Frostberg, MD, USA, 3-11 Aug 1980) | |
| 1 | 6:22660 | *See* PNL-SA-9197 |
| **CONF-800941-** | (19. DOD explosives safety seminar, Los Angeles, CA, USA, 9-11 Sep 1980) | |
| 3 | 6:22526 | *See* SAND-80-1880C |
| **CONF-800979-** | (Workshop on nuclear data evaluation methods and procedures, Upton, NY, USA, 22-25 Sep 1980) | |
| 16 | 6:22858 | *See* BNL-NCS-29035 |
| **CONF-800994-** | (International symposium on H.E. physics with polarized beams and polarized targets, Lausanne, Switzerland, 25 Sep-1 Oct 1980) | |
| 13 | 6:22825 | *See* SLAC-PUB-2674 |
| **CONF-8009140-** | (Workshop on carbon dioxide effects research and assessment program, Woods Hole, MA, USA, 21-25 Sep 1980) | |
| | 6:22554 | NTIS, PC A18/MF A01 |
| | 6:22555 | NTIS, PC A18/MF A01 |
| | 6:22558 | NTIS, PC A18/MF A01 |
| | 6:22559 | NTIS, PC A18/MF A01 |
| | 6:22560 | NTIS, PC A18/MF A01 |
| | 6:22561 | NTIS, PC A18/MF A01 |
| | 6:22562 | NTIS, PC A18/MF A01 |
| | 6:22563 | NTIS, PC A18/MF A01 |
| | 6:22564 | NTIS, PC A18/MF A01 |
| | 6:22565 | NTIS, PC A18/MF A01 |
| | 6:22566 | NTIS, PC A18/MF A01 |
| | 6:22567 | NTIS, PC A18/MF A01 |
| | 6:22568 | NTIS, PC A18/MF A01 |
| | 6:22569 | NTIS, PC A18/MF A01 |
| | 6:22570 | NTIS, PC A18/MF A01 |
| | 6:22571 | NTIS, PC A18/MF A01 |
| **CONF-8009144-** | (ASAE national energy symposium, Kansas City, MO, USA, 29 Sep-1 Oct 1980) | |
| (Vol.1) | 6:21878 | $49.50 per set |
| **CONF-8009150-** | (Photovoltaics program utility interface southwest regional workshop, Pasadena, CA, USA, 9-10 Sep 1980) | |
| | 6:21820 | *See* DOE/ET/20356-2 |
| **CONF-8009151-** | (6. annual ADUA meeting, Denver, CO, USA, 30 Sep-3 Oct 1980) | |
| 2 | 6:22984 | *See* UCRL-84966 |
| 3 | 6:22983 | *See* UCRL-84965 |
| 4 | 6:22982 | *See* UCRL-84964 |
| **CONF-801016-** | (5. national passive solar conference, Amherst, MA, USA, 19-26 Oct 1980) | |
| (Vol.1) | 6:21845 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.1: 497(1980) |
| (Vol.2) | 6:21739 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 782-784(1980) |
| (Vol.2) | 6:21799 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1087-1091(1980) |
| (Vol.2) | 6:21800 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1092-1096(1980) |
| (Vol.2) | 6:21885 | NTIS, PC A99/MF A01 |
| (Vol.2) | 6:21886 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 707-711(1980) |
| (Vol.2) | 6:21887 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 712-716(1980) |
| (Vol.2) | 6:21888 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 717-721(1980) |
| (Vol.2) | 6:21889 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 727-731(1980) |
| (Vol.2) | 6:21890 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 752-756(1980) |
| (Vol.2) | 6:21891 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 800-803(1980) |
| (Vol.2) | 6:21892 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 814-818(1980) |
| (Vol.2) | 6:21893 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 832-835(1980) |
| (Vol.2) | 6:21894 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 841-845(1980) |
| (Vol.2) | 6:21895 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 856-858(1980) |
| (Vol.2) | 6:21896 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 859-863(1980) |
| (Vol.2) | 6:21897 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 869-873(1980) |
| (Vol.2) | 6:21898 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 879-883(1980) |
| (Vol.2) | 6:21899 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 889-893(1980) |
| (Vol.2) | 6:21900 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 894-896(1980) |
| (Vol.2) | 6:21901 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 929-932(1980) |
| (Vol.2) | 6:21902 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 960-964(1980) |
| (Vol.2) | 6:21903 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 965-969(1980) |
| (Vol.2) | 6:21904 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 975-979(1980) |
| (Vol.2) | 6:21905 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 985-989(1980) |
| (Vol.2) | 6:21906 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1003-1006(1980) |

| Report No. | Abstract No. | Availability |
|---|---|---|
| (Vol.2) | 6:21907 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1051-1055(1980) |
| (Vol.2) | 6:21908 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1056-1060(1980) |
| (Vol.2) | 6:21909 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1114-1118(1980) |
| (Vol.2) | 6:21910 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1215-1218(1980) |
| (Vol.2) | 6:21911 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1224-1228(1980) |
| (Vol.2) | 6:21912 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1284-1288(1980) |
| (Vol.2) | 6:21913 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1289-1291(1980) |
| (Vol.2) | 6:22214 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1174-1178(1980) |
| (Vol.2) | 6:22215 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1179-1182(1980) |
| (Vol.2) | 6:22216 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1183-1187(1980) |
| (Vol.2) | 6:22217 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 1210-1214(1980) |
| (Vol.2) | 6:22601 | Proc. Annu. Meet. - Am. Sect. Int. Sol. Energy Soc., 5.2: 797-799(1980) |
| **CONF-801034-** | (33. ACS Pacific Coast meeting, San Francisco, CA, USA, 28 Oct 1980) | |
| 10 | 6:22036 | *See* HEDL-SA-2175 |
| **CONF-801037-** | (American Vacuum Society conference, Detroit, MI, USA, 13-17 Oct 1980) | |
| 12(Rev.1) | 6:21719 | *See* UCRL-84475(Rev.1) |
| **CONF-801039-** | (20. annual Hanford Life Sciences symposium, Richland, WA, USA, 19-23 Oct 1980) | |
| 10 | 6:21516 | *See* PNL-SA-8812 |
| **CONF-801045-** | (DOE statistical symposium, Berkeley, CA, USA, 29-31 Oct 1980) | |
| | 6:22224 | NTIS, PC A11/MF A01 |
| | 6:22225 | NTIS, PC A11/MF A01 |
| | 6:22510 | NTIS, PC A11/MF A01 |
| | 6:22538 | NTIS, PC A11/MF A01 |
| | 6:22539 | NTIS, PC A11/MF A01 |
| | 6:22540 | NTIS, PC A11/MF A01 |
| | 6:22541 | NTIS, PC A11/MF A01 |
| | 6:22671 | NTIS, PC A11/MF A01 |
| | 6:22703 | NTIS, PC A11/MF A01 |
| **CONF-801098-** | (2. DOE-ENEL workshop for cooperative research in geothermal energy, Berkeley, CA, USA, 20-22 Oct 1980) | |
| 2 | 6:21960 | *See* LBL-12174 |
| 3 | 6:21968 | *See* LBL-12175 |
| **CONF-8010185-** | (31. Aeroballistic Range Association conference, Pasadena, CA, USA, 7 Oct 1980) | |
| 1 | 6:22432 | *See* UCRL-85016 |
| **CONF-801138-** | (Electromagnetic guns and launchers conference, San Diego, CA, USA, 4-6 Nov 1980) | |
| 2(Rev.1) | 6:22429 | *See* UCRL-84875(Rev.1) |
| 5(Rev.1) | 6:22430 | *See* UCRL-84876(Rev.1) |
| **CONF-801233-** | (6. annual workshop on geothermal reservoir engineering, Stanford, CA, USA, 16-18 Dec 1980) | |
| 9 | 6:21967 | *See* LBL-11940 |
| **CONF-801252-** | (IGT symposium on peat as an energy alternative, Arlington, VA, USA, 1-3 Dec 1980) | |
| | 6:21547 | $50.00 |
| **CONF-801254-** | (Resource recovery conference, Washington, DC, USA, 12 Dec 1980) | |
| (Absts) | 6:22244 | Washington, DC; National Center for Resource Recovery, Inc. (1980). |
| **CONF-801255-** | (Workshop on foundations of the relativistic theory of atomic structure, Argonne, IL, USA, 4-5 Dec 1980) | |
| | 6:22748 | *See* ANL-80-126 |
| | 6:22749 | *See* ANL-80-126 |
| | 6:22750 | *See* ANL-80-126 |
| | 6:22751 | *See* ANL-80-126 |
| | 6:22752 | *See* ANL-80-126 |
| | 6:22753 | *See* ANL-80-126 |
| | 6:22754 | *See* ANL-80-126 |
| | 6:22755 | *See* ANL-80-126 |
| | 6:22756 | *See* ANL-80-126 |
| | 6:22757 | *See* ANL-80-126 |
| | 6:22758 | *See* ANL-80-126 |
| | 6:22759 | *See* ANL-80-126 |
| | 6:22760 | *See* ANL-80-126 |
| | 6:22761 | *See* ANL-80-126 |
| | 6:22762 | *See* ANL-80-126 |
| | 6:22763 | *See* ANL-80-126 |
| | 6:22764 | *See* ANL-80-126 |
| | 6:22765 | *See* ANL-80-126 |
| | 6:22766 | *See* ANL-80-126 |
| | 6:22767 | *See* ANL-80-126 |
| | 6:22768 | *See* ANL-80-126 |
| **CONF-801258-** | (Seminaire des evaluations des risques et processus de decision, Orsay, France, 17-19 Dec 1980) | |
| 1 | 6:22694 | *See* LBL-12555 |
| **CONF-810135-** | (Neutrino oscillation workshop, Upton, NY, USA, 30 Jan 1981) | |
| 3 | 6:22736 | *See* BNL-29440 |
| **CONF-810140-** | (Community energy planning conference, Gatlinburg, TN, USA, 20-21 Jan 1981) | |
| 1 | 6:22112 | NTIS, PC A02/MF A01 |
| **CONF-810142-** | (5. skyline logging symposium, Seattle, WA, USA, 27-28 Jan 1981) | |
| 1 | 6:22425 | *See* PNL-SA-8797 |
| **CONF-810203-** | (110. annual meeting of the AIME, Chicago, IL, USA, 22-26 Feb 1981) | |
| 11 | 6:21616 | *See* LA-UR-81-1196 |
| **CONF-810217-** | (ANS waste management conference, Tucson, AZ, USA, 23-26 Feb 1981) | |
| 16 | 6:21682 | *See* PNL-SA-9231 |
| **CONF-810226-** | (2. DOE/NASA wind turbine dynamics workshop, Cleveland, OH, USA, 24-26 Feb 1981) | |
| 5 | 6:21988 | *See* SAND-81-1108C |
| **CONF-810246-** | (Z/sup o/ physics workshop, Ithaca, NY, USA, 6-8 Feb 1981) | |
| 3 | 6:22817 | *See* BNL-29465 |
| 4 | 6:22822 | *See* BNL-29468 |
| **CONF-810308-** | (American Chemical Society symposium on the chemistry of engine combustion deposits, Atlanta, GA, USA, 29 Mar-3 Apr 1981) | |
| 12 | 6:22336 | *See* RHO-SA-218 |
| (Vol.1) | 6:21576 | Am. Chem. Soc., Div. Pet. Chem., Prepr., 26: No. 1, 132-145(Feb 1981) |
| (Vol.1) | 6:21577 | Am. Chem. Soc., Div. Pet. Chem., Prepr., 26: No. 1, 169-174(Feb 1981) |
| (Vol.1) | 6:21578 | Am. Chem. Soc., Div. Pet. Chem., Prepr., 26: No. 1, 185-194(Feb 1981) |
| (Vol.1) | 6:21579 | Am. Chem. Soc., Div. Pet. Chem., Prepr., 26: No. 1, 199-210(Feb 1981) |
| (Vol.1) | 6:21580 | Univ. of Utah, Salt Lake City |
| (Vol.1) | 6:22310 | Am. Chem. Soc., Div. Pet. Chem., Prepr., 26: No. 1, 156-168(Feb 1981) |
| (Vol.2) | 6:21581 | Am. Chem. Soc., Div. Pet. Chem., Prepr., 26: No. 2, 377-383(Mar 1981) |
| (Vol.2) | 6:21582 | J.W. Bunger, Treasurer, University of Utah, Salt Lake City, UT 84112 |
| **CONF-810314-** | (Particle accelerator conference, Washington, DC, USA, 11-13 Mar 1981) | |
| 62 | 6:22481 | *See* BNL-29243 |
| 127 | 6:22493 | *See* SLAC-PUB-2664 |
| 128 | 6:22502 | *See* SLAC-PUB-2702 |
| 129 | 6:22496 | *See* SLAC-PUB-2682 |
| 131 | 6:22491 | *See* LBL-11725 |
| 138 | 6:22498 | *See* SLAC-PUB-2689 |
| 139 | 6:22476 | *See* SLAC-PUB-2688 |
| 140 | 6:22499 | *See* SLAC-PUB-2691 |
| 141 | 6:22468 | *See* LBL-11580 |
| 142 | 6:22489 | *See* LBL-11715 |
| 143 | 6:22469 | *See* LBL-11726 |
| 144 | 6:22473 | *See* SLAC-PUB-2673 |
| 145 | 6:22475 | *See* SLAC-PUB-2683 |
| 146 | 6:22497 | *See* SLAC-PUB-2684 |
| 148 | 6:22500 | *See* SLAC-PUB-2698 |
| 149 | 6:22501 | *See* SLAC-PUB-2701 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 150 | 6:22504 | *See* SLAC-PUB-2704 |
| 151 | 6:22503 | *See* SLAC-PUB-2703 |
| 152 | 6:22474 | *See* SLAC-PUB-2678 |
| 153 | 6:22477 | *See* SLAC-PUB-2690 |
| 154 | 6:22470 | *See* SLAC-PUB-2666 |
| 155 | 6:22471 | *See* SLAC-PUB-2670 |
| 156 | 6:22472 | *See* SLAC-PUB-2672 |
| 157 | 6:22494 | *See* SLAC-PUB-2675 |
| 158 | 6:22487 | *See* LBL-11709 |
| 159 | 6:22488 | *See* LBL-11713 |
| 160 | 6:22917 | *See* LA-UR-81-1408 |
| 162 | 6:22490 | *See* LBL-11719 |
| **CONF-810340-** | (7. international conference on magnet technology, Karlsrube, F.R. Germany, 30 Mar-3 Apr 1981) | |
| 11 | 6:22495 | *See* SLAC-PUB-2677 |
| **CONF-810365-** | (Joint meeting of the Columbia and Northern California chapters of the Health Physics Society on internal dosimetry, Lake Tahoe, CA, USA, 22-24 Mar 1981) | |
| 1 | 6:22861 | *See* PNL-SA-9333 |
| **CONF-810366-** | (Remote maintenance equipment workshop, Oak Ridge, TN, USA, 12-13 Mar 1981) | |
| 1 | 6:22485 | *See* LA-UR-81-1324 |
| **CONF-810367-** | (Fuze section annual meeting (ADPA), San Diego, CA, USA, 17-18 Mar 1981) | |
| 2 | 6:22530 | *See* UCRL-85730 |
| **CONF-810371-** | (Los Angeles chapter of American Meteorological Society meeting, Los Angeles, CA, USA, 18 Mar 1981) | |
| 1 | 6:22526 | *See* SAND-80-1880C |
| **CONF-810372-** | (Symposium on uncertainties associated with the regulation of the geologic disposal of high-level radioactive waste, Gatlinburg, TN, USA, 9-15 Mar 1981) | |
| 1 | 6:21681 | *See* PNL-SA-9092 |
| 2 | 6:22725 | *See* PNL-SA-9096 |
| **CONF-810373-** | (5. international conference on fracture, Cannes, France, 29 Mar-3 Apr 1981) | |
| 1 | 6:22087 | *See* UCRL-84347 |
| **CONF-810377-** | (WESTEC conference, Boulder, CO, USA, 23-25 Mar 1981) | |
| 1 | 6:22423 | *See* LA-UR-81-1643 |
| **CONF-810378-** | (12. lunar and planetary science conference, Houston, TX, USA, 16-20 Mar 1981) | |
| 1 | 6:22737 | *See* BNL-29527 |
| **CONF-810379-** | (Society of Well Log Analyst's annual meeting, Mexico City, Mexico, 20-23 Mar 1981) | |
| 1 | 6:21961 | *See* LA-UR-81-1092 |
| **CONF-810406-** | (27. international instrumentation symposium, Indianapolis, IN, USA, 27-30 Apr 1981) | |
| 4 | 6:22071 | NTIS, PC A02/MF A01 |
| 5 | 6:22971 | NTIS, PC A02/MF A01 |
| 6 | 6:22074 | *See* EGG-M-00881 |
| 7 | 6:22972 | NTIS, PC A02/MF A01 |
| **CONF-810410-** | (Scanning electron microscopy conference, Dallas, TX, USA, 14-18 Apr 1981) | |
| 4(Rev.1) | 6:21605 | *See* UCRL-85331(Rev.1) |
| **CONF-810415-** | (ANS/ENS joint topical meeting on mathematical methods in nuclear engineering, Munich, F.R. Germany, 27-29 Apr 1981) | |
| 9 | 6:22077 | *See* HEDL-SA-2244-FP |
| 10 | 6:22078 | *See* HEDL-SA-2244-S |
| **CONF-810417-** | (90. AICHE national meeting, Houston, TX, USA, 5-9 Apr 1981) | |
| 6 | 6:21489 | NTIS, PC A03/MF A01 |
| 7 | 6:21600 | Chicago, IL; Institute of Gas Technology (1981). |
| **CONF-810421-** | (Ionospheric effects symposium, Alexandria, VA, USA, 14-16 Apr 1981) | |
| 3 | 6:22743 | NTIS, PC A02/MF A01 |
| **CONF-810423-** | (1. International Energy Agency (IEA) conference on new energy conservation technologies and their commercialization, Berlin, F.R. Germany, 6-10 Apr 1981) | |
| 6 | 6:22206 | *See* LBL-11701 |
| **CONF-810424-** | (ARRAY user's annual conference, St Louis, MO, USA, 26 Apr 1981) | |
| 3 | 6:22974 | *See* LA-UR-81-1082 |
| **CONF-810425-** | (International conference on metallurgical coatings, San Francisco, CA, USA, 6-10 Apr 1981) | |
| 6 | 6:21720 | *See* UCRL-85140 |
| **CONF-810429-** | (Conference on optics, Santa Fe, NM, USA, 6-10 Apr 1981) | |
| 10 | 6:22519 | *See* LA-UR-81-1074 |
| 11 | 6:22434 | *See* LA-UR-81-1232 |
| 12 | 6:22913 | *See* LA-UR-81-1229 |
| 13 | 6:22914 | *See* LA-UR-81-1245 |
| 15 | 6:22775 | *See* LA-UR-81-1157 |
| 16 | 6:22420 | *See* LA-UR-81-1038 |
| 17 | 6:22879 | *See* LA-UR-81-1028 |
| 18 | 6:22520 | *See* LA-UR-81-1126 |
| 20 | 6:22880 | *See* LA-UR-81-1148 |
| 22 | 6:22776 | *See* LA-UR-81-1228 |
| 23 | 6:22435 | *See* LA-UR-81-1565 |
| 26 | 6:22881 | *See* LA-UR-81-1435 |
| 28 | 6:22915 | *See* LA-UR-81-1394 |
| 29 | 6:22916 | *See* LA-UR-81-1404 |
| 30 | 6:22312 | *See* LA-UR-81-1443 |
| 33 | 6:22436 | *See* LA-UR-81-1567 |
| **CONF-810432-** | (Atomic physic program contractors' workshop, Argonne, IL, USA, 1-2 Apr 1981) | |
| 3 | 6:22769 | NTIS, PC A02/MF A01 |
| 4 | 6:22770 | NTIS, PC A02/MF A01 |
| **CONF-810442-** | (Joint workshop on negative ions, Mexico City, Mexico, 1-4 Apr 1981) | |
| 2 | 6:22790 | *See* UCRL-85577 |
| 2(Rev.1) | 6:22791 | *See* UCRL-85577(Rev.1) |
| **CONF-810466-** | (Spring meeting of the Western States Section of the Combustion Institute, Pullman, WA, USA, 13-14 Apr 1981) | |
| 3 | 6:22465 | *See* LBL-12215 |
| **CONF-810467-** | (SIGMODE international conference on management of data, Ann Arbor, MI, USA, 29-30 Apr 1981) | |
| 2 | 6:22990 | *See* LBL-12350 |
| **CONF-810468-** | (3. international conference on electrostatic accelerator technology, Oak Ridge, TN, USA, 13-16 Apr 1981) | |
| 2 | 6:22482 | *See* DOE/ER/01388-489 |
| 4 | 6:22466 | *See* DOE/ER/01388-488 |
| **CONF-810469-** | (Solar Thermal Test Facilities Users Association annual business and technical meeting, Pasadena, CA, USA, 20-24 Apr 1981) | |
| 1 | 6:21722 | *See* UCRL-85743 |
| **CONF-810471-** | (1. Sino/U.S. geothermal resources conference, Tianjin, China, 5-11 Apr 1981) | |
| 1 | 6:21976 | NTIS, PC A02/MF A01 |
| **CONF-810473-** | (13. symposium and research progress review meeting for present and potential sponsors, West Lafayette, IN, USA, 23-24 Apr 1981) | |
| 1 | 6:21490 | NTIS, PC A02/MF A01 |
| **CONF-810474-** | (Workshop for experiments as 50x50 GeV, Ithaca, NY, USA, Apr 1981) | |
| 1 | 6:22483 | *See* DOE/ER/03072-1 |
| **CONF-810475-** | (Workshop on physics and chemistry of energy-related atmospheric pollution, Harper's Ferry, WV, USA, 21-23 Apr 1981) | |
| 1 | 6:22546 | *See* LBL-12539 |
| 2 | 6:22532 | *See* LBL-12540 |
| **CONF-810476-** | (VIM 34 conference, Chicago, IL, USA, Apr 1981) | |
| 1 | 6:22975 | *See* LA-UR-81-1192 |
| **CONF-810502-** | (3. symposium on safeguards and nuclear material management, Karlsruhe, F.R. Germany, 6 May-8 Mar 1981) | |
| 9 | 6:21695 | *See* LA-UR-81-1402 |
| **CONF-810509-** | (Annual conference of the International Solar Energy Society, Philadelphia, PA, USA, 26-30 May 1981) | |
| 29 | 6:22169 | *See* BNL-29480 |
| 30 | 6:21746 | *See* LA-UR-81-1201 |
| 32 | 6:21822 | *See* DOE/NASA/20485-8 |
| 34 | 6:21862 | *See* LA-UR-81-1039 |
| **CONF-810523-** | (Topical conference on computerized data acquisition in particle and nuclear physics, Oak Ridge, TN, USA, 28-30 May 1981) | |
| 6 | 6:22486 | *See* LA-UR-81-1640 |
| **CONF-810526-** | (15. IEEE PV specialists conference, Orlando, FL, USA, 11-15 May 1981) | |
| 10 | 6:21793 | *See* SERI/TP-612-1190 |
| 11 | 6:21776 | *See* SAND-81-1145C |
| 13 | 6:21774 | *See* SAND-80-2206C |
| 14(Draft) | 6:21780 | *See* SAND-81-7113C |
| 15 | 6:21818 | *See* DOE/ET/20279-135 |
| 16 | 6:21817 | *See* DOE/ET/20279-133 |
| 17 | 6:21814 | *See* DOE/ET/20279-123 |
| 18 | 6:21813 | *See* DOE/ET/20279-118 |
| 19 | 6:21779 | *See* SAND-81-1222C |
| 20 | 6:21824 | *See* SAND-81-1193C |
| 21 | 6:21778 | *See* SAND-81-1211C |
| 22 | 6:21940 | *See* DOE/ET/20279-137 |
| 23 | 6:21762 | *See* DOE/ET/20279-134 |
| 24 | 6:21816 | *See* DOE/ET/20279-132 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 25 | 6:21777 | *See* SAND-81-1191C |
| 26(Draft) | 6:21758 | NTIS, PC A02/MF A01 |
| 27 | 6:21759 | NTIS, PC A02/MF A01 |
| 28(Draft) | 6:21760 | NTIS, PC A02/MF A01 |
| **CONF-810531-** | (3. annual site development and land use planning conference, Batavia, IL, USA, 5-7 May 1981) | |
| 1 | 6:22557 | NTIS, PC A02/MF A01 |
| **CONF-810540-** | (1. European conference on cineradiography with photons or particles, Paris, France, 19-21 May 1981) | |
| 1 | 6:22524 | *See* LA-UR-81-1270 |
| **CONF-810545-** | (3. conference on waste heat management and utilization, Miami, FL, USA, 12 May 1981) | |
| 2 | 6:22007 | NTIS, PC A02/MF A01 |
| **CONF-810546-** | (1981 spring DECUS U.S. symposium, Miami Beach, FL, USA, 18-21 May 1981) | |
| 1 | 6:22448 | *See* UCRL-85254 |
| 2 | 6:22985 | *See* UCRL-85310 |
| **CONF-810547-** | (4. international coral reef symposium, Manila, Philippines, 18-22 May 1981) | |
| 1 | 6:22726 | *See* UCRL-85411 |
| **CONF-810548-** | (29. annual conference on mass spectrometery, Minneapolis, MN, USA, 24-29 May 1981) | |
| 3 | 6:21693 | NTIS, PC A02/MF A01 |
| **CONF-810550-** | (35. annual frequency control symposium, Philadelphia, PA, USA, 27-29 May 1981) | |
| 1 | 6:22518 | *See* SAND-81-0126C |
| **CONF-810551-** | (ASME/USEPA hazardous waste incineration conference, Williamsburg, VA, USA, 27-28 May 1981) | |
| 1 | 6:21670 | *See* DP-MS-81-8 |
| **CONF-810553-** | (Specialists' meeting on natural convection decay heat removal, Grenoble, France, 20-21 May 1981) | |
| 1 | 6:22072 | NTIS, PC A02/MF A01 |
| **CONF-810554-** | (3. symposium on biotechnology in energy production and conservation, Gatlinburg, TN, USA, 12-15 May 1981) | |
| 1 | 6:22648 | NTIS, PC A02/MF A01 |
| **CONF-810563-** | (Adriatic europhysics study on nuclear physics dynamics of heavy-ion collisions conference, Croatia, Yugoslavia, 25-30 May 1981) | |
| 1 | 6:22854 | *See* LA-UR-81-1555 |
| **CONF-810565-** | (Workshop on status of research and methods of evaluation of appropriate technology of environmental interaction, Gainesville, FL, USA, 14-16 May 1981) | |
| 1 | 6:22247 | NTIS, PC A02/MF A01 |
| **CONF-810566-** | (International conference on fast ionic transport in solids, Gatlinburg, TN, USA, 18-22 May 1981) | |
| 2 | 6:22091 | *See* LBL-12445 |
| **CONF-810567-** | (64. chemical conference, Halifax, Nova Scotia, Canada, 31 May-3 Jun 1981) | |
| 1 | 6:21992 | NTIS, PC A02/MF A01 |
| **CONF-810572-** | (Geothermal Resources Council symposium, Portland, OR, USA, 19-22 May 1981) | |
| 1 | 6:21972 | *See* LA-UR-81-1430 |
| **CONF-810602-** | (7. symposium on detonation, Annapolis, MD, USA, 19 Jun 1981) | |
| 25 | 6:22523 | *See* LA-UR-81-1067 |
| **CONF-810606-** | (American Nuclear Society's annual meeting, Miami Beach, FL, USA, 7-12 Jun 1981) | |
| 31 | 6:22050 | *See* GA-A-16262 |
| 35 | 6:21669 | *See* DP-MS-80-123 |
| 36 | 6:21672 | *See* LA-UR-81-1385 |
| **CONF-810607-** | (Symposium on instrumentation and control for fossil energy processes, San Francisco, CA, USA, 8-12 Jun 1981) | |
| 1 | 6:21612 | *See* UCRL-85845 |
| 2 | 6:22329 | *See* LA-UR-81-1526 |
| **CONF-810614-** | (16. thermophysics conference, Palo Alto, CA, USA, 23-25 Jun 1981) | |
| 5 | 6:22273 | *See* LA-UR-81-1400 |
| 6 | 6:21573 | *See* SAND-81-0101C |
| **CONF-810615-** | (2. joint US/Japan LMFBR steam generator seminar, Sunnyvale, CA, USA, 1-5 Jun 1981) | |
| 2 | 6:22031 | NTIS, PC A03/MF A01 |
| **CONF-810621-** | (Symposium on fluid mechanics of combustion systems, Boulder, CO, USA, 22-24 Jun 1981) | |
| 2 | 6:22259 | *See* SAND-81-8642 |
| **CONF-810623-** | (24. midwest symposium on circuits and systems, Albuquerque, NM, USA, 29-30 Jun 1981) | |
| 2 | 6:22976 | *See* SAND-81-0691C |
| **CONF-810624-** | (22. US symposium on rock mechanics, Cambridge, MA, USA, 29 Jun-2 Jul 1981) | |
| 6 | 6:21673 | *See* LBL-12478 |
| 7 | 6:22730 | *See* LBL-12511 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **CONF-810625-** | (ASME PVP conference, Denver, CO, USA, 21-26 Jun 1981) | |
| 11 | 6:22060 | *See* HEDL-SA-2275-FP |
| 12 | 6:22061 | *See* HEDL-SA-2278-FP |
| 13 | 6:22032 | NTIS, PC A02/MF A01 |
| 14 | 6:22033 | NTIS, PC A02/MF A01 |
| 15 | 6:22073 | NTIS, PC A02/MF A01 |
| 16 | 6:22034 | NTIS, PC A02/MF A01 |
| **CONF-810637-** | (11. transducer workshop, Seattle, WA, USA, 2 Jun 1981) | |
| 1 | 6:21971 | *See* EGG-1183-1797 |
| 2 | 6:22442 | *See* EGG-1183-1800 |
| **CONF-810638-** | (4. conference on atmospheric radiation, Toronto, Ontario, Canada, 16-18 Jun 1981) | |
| 1 | 6:22533 | *See* UCRL-85958 |
| **CONF-810639-** | (19. symposium on the engineering aspects of magnetohydrodynamics, Tullahoma, TN, USA, 15-17 Jun 1981) | |
| 1 | 6:22151 | *See* DOE/NASA/10769-16 |
| **CONF-810640-** | (17. State-of-the-art symposium, Washington, DC, USA, 8-10 Jun 1981) | |
| 1 | 6:22279 | *See* SAND-81-0558C |
| **CONF-810642-** | (4. DOE battery and electrochemical contractor's conference, Washington, DC, USA, 2-4 Jun 1981) | |
| 1 | 6:22094 | *See* SAND-81-7116C |
| 2 | 6:22095 | *See* SAND-81-7119C |
| 4 | 6:22093 | *See* SAND-81-7115C |
| **CONF-810643-** | (1. international specialists meeting on BWR-pressure suppression containment technology, Geesthacht, F.R. Germany, 1-3 Jun 1981) | |
| 1 | 6:22083 | *See* UCRL-85707 |
| **CONF-810644-** | (5. international workshop on rare earth-cobalt magnets and their application, Dayton, OH, USA, 6-7 Jun 1981) | |
| 1 | 6:22492 | *See* LBL-12552 |
| **CONF-810647-** | (Conference on X-and gamma-ray sources and applications, Ann Arbor, MI, USA, 10-12 Jun 1981) | |
| 1 | 6:22054 | *See* DP-MS-80-120 |
| 2 | 6:22328 | *See* LA-UR-81-1511 |
| 4 | 6:22330 | *See* LA-UR-1461 |
| 5 | 6:21696 | *See* LA-UR-81-1510 |
| **CONF-810701-** | (Computer simulation conference, Washington, DC, USA, 15-17 Jul 1981) | |
| 1 | 6:22427 | *See* SAND-80-2549C |
| 2 | 6:22227 | *See* LA-UR-81-813 |
| 3 | 6:22912 | *See* HEDL-SA-2253 |
| **CONF-810702-** | (International conference on numerical methods for laminar and turbulent flow, Venice, Italy, 13-16 Jul 1981) | |
| 1 | 6:22445 | *See* UCRL-85354 |
| 2 | 6:22443 | *See* UCRL-84691 |
| 3 | 6:22444 | *See* UCRL-85337 |
| 7 | 6:22542 | *See* DP-MS-80-84 |
| 8 | 6:22543 | *See* DP-MS-80-85 |
| **CONF-810704-** | (1. international specialists meeting of the Combustion Institute, Bordequx, France, 20-25 Jul 1981) | |
| 1 | 6:21731 | *See* UCRL-85409 |
| 2 | 6:21596 | *See* LBL-12128 |
| 3 | 6:22364 | *See* LBL-12127 |
| 4 | 6:22415 | *See* LBL-12141 |
| 5 | 6:21727 | *See* LBL-12146 |
| **CONF-810705-** | (16. annual conference of the Microbeam Analysis Society, Vail, CO, USA, 13-17 Jul 1981) | |
| 1 | 6:22787 | *See* SAND-81-0203C |
| 2 | 6:22337 | *See* SAND-81-0331C |
| 3 | 6:22278 | *See* SAND-81-0147C |
| **CONF-810706-** | (Institute of Nuclear Materials Management conference, San Francisco, CA, USA, 13 Jul 1981) | |
| 1 | 6:21698 | *See* SAND-81-0495C |
| 2 | 6:21650 | *See* SAND-81-0605C |
| **CONF-810707-** | (IEEE conference on nuclear science and space radiation, Seattle, WA, USA, 21-24 Jul 1981) | |
| 1 | 6:22456 | *See* SAND-81-0658C |
| 2 | 6:22062 | *See* SAND-81-0749C |
| **CONF-810708-** | (2. international conference on numerical methods in thermal problems, Venice, Italy, 7-10 Jul 1981) | |
| 1 | 6:21684 | *See* SAND-80-2016 |
| 3 | 6:22446 | *See* UCRL-85366 |
| **CONF-810711-** | (17. international cosmic ray conference, Paris, France, 13-25 Jul 1981) | |
| 1 | 6:22739 | *See* LA-UR-81-965 |
| 2 | 6:22740 | *See* LA-UR-81-966 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **CONF-810712-** | | (Annual conference on chemical and mechanical technologies of propellants and explosives, Karlsruhe, F.R. Germany, 1-3 Jul 1981) |
| 1 | 6:22522 | *See* LA-UR-81-992 |
| **CONF-810713-** | | (1. international specialists' meeting of the Combustion Institute, Pittsburgh, PA, USA, 20-25 Jul 1981) |
| 1 | 6:22416 | *See* LBL-12214 |
| **CONF-810714-** | | (Conference on ground control in mining, Morgantown, WV, USA, 27-29 Jul 1981) |
| 1 | 6:21546 | *See* SAND-81-1069C |
| **CONF-810715-** | | (11. inter-society conference on environmental systems, San Francisco, CA, USA, 13-15 Jul 1981) |
| 1 | 6:22421 | *See* LA-UR-81-1084 |
| **CONF-810717-** | | (International conference on internal friction and ultrasonic attenuation in solids, Lausanne, Switzerland, Jul 1981) |
| 1 | 6:22268 | *See* DOE/ER/01198-1352 |
| **CONS-** | | |
| 5089-15 | 6:22266 | NTIS, PC A04/MF A01 |
| **COO-** | | |
| 2218-216 | 6:22878 | *See* DOE/ET/52040-T2 |
| 2263-16 | 6:22154 | *See* DOE/ET/11293-T3 |
| 2364-18 | 6:22673 | *See* DOE/EV/02364-T1 |
| 2472-07 | 6:22637 | *See* DOE/EV/02472-T1 |
| 4355-11 | 6:22269 | *See* DOE/ET/26214-T1 |
| 4426-4 | 6:22393 | *See* DOE/ER/04426-4 |
| 4575-2 | 6:21542 | *See* DOE/ET/10466-T1 |
| 4974-3 | 6:22772 | *See* DOE/ER/04974-T1 |
| 5911-5 | 6:22484 | *See* DOE/ER/05911-T1 |
| 10438-3 | 6:22295 | *See* DOE/ER/10438-T1 |
| **CW-WR-** | | |
| 76-02048A | 6:21996 | *See* DOE/ET/10348-T2 |
| **DOE/BC/10003-** | | |
| 18 | 6:21602 | NTIS, PC A08/MF A01 |
| **DOE/BC/10300-** | | |
| 10 | 6:21569 | NTIS, PC A02/MF A01 |
| **DOE/BETC/RI-** | | |
| 81/ 2 | 6:21592 | NTIS, PC A02/MF A01 |
| **DOE/BP-** | | |
| 32 | 6:22117 | NTIS, PC A05/MF A01 |
| 13061(Vol.1) | 6:22178 | NTIS, PC A05/MF A01 |
| 13061(Vol.2) | 6:22179 | NTIS, PC A06/MF A01 |
| 13061(Vol.3) | 6:22180 | NTIS, PC A07/MF A01 |
| 13061(Vol.4) | 6:22181 | NTIS, PC A11/MF A01 |
| 13061(Vol.5) | 6:22182 | NTIS, PC A11/MF A01 |
| 13061(Vol.6) | 6:22183 | NTIS, PC A11/MF A01 |
| 13061(Vol.7) | 6:22184 | NTIS, PC A11/MF A01 |
| 13061(Vol.8) | 6:22185 | NTIS, PC A11/MF A01 |
| 13061(Vol.9) | 6:22186 | NTIS, PC A11/MF A01 |
| 13061(Vol.10) | 6:22187 | NTIS, PC A11/MF A01 |
| 13061(Vol.11) | 6:22188 | NTIS, PC A11/MF A01 |
| 13061(Vol.12) | 6:22189 | NTIS, PC A11/MF A01 |
| **DOE/CE-** | | |
| 0002 | 6:22166 | NTIS, PC A24/MF A01 |
| 0005 | 6:21725 | NTIS, PC A05/MF A01 |
| **DOE/CE/20167-** | | |
| 05 | 6:22238 | NTIS, PC A06/MF A01 |
| **DOE/CE/20220-** | | |
| 1 | 6:22190 | NTIS, PC A09/MF A01 |
| **DOE/CE/56051-** | | |
| 3 | 6:22140 | NTIS, PC A03/MF A01 |
| **DOE/CE/60467-** | | |
| 02 | 6:22191 | NTIS, PC A03/MF A01 |
| **DOE/CH/00135-** | | |
| 3 | 6:21841 | NTIS, PC A13/MF A01 |
| **DOE/CS/20068-** | | |
| 4(Vol.2) (App.) | 6:22192 | NTIS, PC A10/MF A01 |
| **DOE/CS/20100-** | | |
| T2 | 6:22256 | NTIS, PC A05/MF A01 |
| **DOE/CS/24310-** | | |
| 3 | 6:21726 | NTIS, PC A02/MF A01 |
| **DOE/CS/30133-** | | |
| T1(Vol.1) | 6:21937 | NTIS, PC A12/MF A01 |
| T1(Vol.2) | 6:21938 | NTIS, PC A17/MF A01 |
| **DOE/CS/30169-** | | |
| 6 | 6:21846 | NTIS, PC A03/MF A01 |
| **DOE/CS/30210-** | | |
| T1 | 6:21847 | NTIS, PC A06/MF A01 |
| **DOE/CS/30224-** | | |
| T1 | 6:21848 | NTIS, PC A05/MF A01 |
| **DOE/CS/30278-** | | |
| T4 | 6:21736 | NTIS, PC A06/MF A01 |
| **DOE/CS/30367-** | | |
| 4 | 6:21849 | NTIS, PC A04/MF A01 |
| T1 | 6:21850 | NTIS, PC A02/MF A01 |
| **DOE/CS/31587-** | | |
| T2 | 6:21851 | NTIS, PC A06/MF A01 |
| **DOE/CS/32867-** | | |
| T1 | 6:21852 | NTIS, PC A08/MF A01 |
| **DOE/CS/35349-** | | |
| T1 | 6:21939 | NTIS, PC A08/MF A01 |
| **DOE/CS/40037-** | | |
| T1 | 6:21558 | NTIS, PC A05/MF A01 |
| T2 | 6:21559 | NTIS, PC A04/MF A01 |
| **DOE/CS/40183-** | | |
| T1 | 6:22239 | NTIS, PC A05/MF A01 |
| **DOE/CS/40284-** | | |
| T1 | 6:22267 | NTIS, PC A09/MF A01 |
| **DOE/CS/40352-** | | |
| T2 | 6:21732 | NTIS, PC A04/MF A01 |
| **DOE/CS/54209-** | | |
| 2 | 6:22261 | NTIS, PC A09/MF A01 |
| **DOE/CS/60419-** | | |
| T1 | 6:22248 | NTIS, PC A04/MF A01 |
| **DOE/DP/40003-** | | |
| T1 | 6:22905 | NTIS, PC A05/MF A01 |
| T1 | 6:22906 | NTIS, PC A05/MF A01 |
| T1 | 6:22907 | NTIS, PC A05/MF A01 |
| T1 | 6:22908 | NTIS, PC A05/MF A01 |
| **DOE/DP/40012-** | | |
| T1 | 6:22909 | NTIS, PC A03/MF A01 |
| **DOE/DP/40017-** | | |
| T1 | 6:22771 | NTIS, PC A02/MF A01 |
| **DOE/DP/40094-** | | |
| T1 | 6:22305 | NTIS, PC A02/MF A01 |
| **DOE/EIA/06278-** | | |
| T1 | 6:21583 | NTIS, PC A02/MF A01 |
| T2 | 6:21584 | NTIS, PC A03/MF A01 |
| **DOE/EIA/10169-** | | |
| T1 | 6:21585 | NTIS, PC A02/MF A01 |
| **DOE/EIA/10189-** | | |
| T1 | 6:21737 | NTIS, PC A08/MF A01 |
| T2 | 6:21853 | NTIS, PC A04/MF A01 |
| T3 | 6:21738 | NTIS, PC A03/MF A01 |
| **DOE/EIA/10221-** | | |
| T2 | 6:21586 | NTIS, PC A03/MF A01 |
| **DOE/EIA/10297-** | | |
| T1 | 6:21587 | NTIS, PC A02/MF A01 |
| **DOE/EIA/10313-** | | |
| T4 | 6:22989 | NTIS, PC A02/MF A01 |
| **DOE/EIS-** | | |
| 0060 | 6:22010 | NTIS, PC A15/MF A01 |
| **DOE/EML-** | | |
| 392 | 6:22672 | NTIS, PC A05/MF A01 |
| **DOE/EP-** | | |
| 0005 | 6:22011 | NTIS, PC A25/MF A01 |
| **DOE/ER-** | | |
| 0099 | 6:21811 | NTIS, PC A11/MF A01 |
| 10727 | 6:22058 | NTIS, PC A02/MF A01 |
| **DOE/ER/00511-** | | |
| T1 | 6:22511 | NTIS, PC A02/MF A01 |
| **DOE/ER/01198-** | | |
| 1351 | 6:21536 | NTIS, PC A02/MF A01 |
| 1352 | 6:22268 | NTIS, PC A02/MF A01 |
| **DOE/ER/01388-** | | |
| 488 | 6:22466 | NTIS, PC A02/MF A01 |
| 489 | 6:22482 | NTIS, PC A02/MF A01 |
| **DOE/ER/02271-** | | |
| T2 | 6:22835 | NTIS, PC A02/MF A01 |
| **DOE/ER/03072-** | | |
| 1 | 6:22483 | NTIS, PC A02/MF A01 |
| **DOE/ER/03992-** | | |
| 423 | 6:22823 | NTIS, PC A02/MF A01 |
| **DOE/ER/04426-** | | |
| 4 | 6:22393 | NTIS, PC A03/MF A01 |
| **DOE/ER/04447-** | | |
| 124 | 6:22363 | NTIS, PC A08/MF A01 |
| **DOE/ER/04634-** | | |
| 1 | 6:22738 | NTIS, PC A02/MF A01 |
| **DOE/ER/04974-** | | |
| T1 | 6:22772 | NTIS, PC A02/MF A01 |
| **DOE/ER/05016-** | | |
| 3 | 6:22326 | NTIS, PC A03/MF A01 |
| **DOE/ER/05911-** | | |
| T1 | 6:22484 | NTIS, PC A04/MF A01 |
| **DOE/ER/05940-** | | |
| 2 | 6:22467 | NTIS, PC A02/MF A01 |
| **DOE/ER/10160-** | | |
| T3 | 6:21751 | NTIS, PC A02/MF A01 |
| T4 | 6:21812 | NTIS, PC A03/MF A01 |
| **DOE/ER/10438-** | | |
| T1 | 6:22295 | NTIS, PC A02/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| DOE/ER/10749- | | |
| 1 | 6:22773 | NTIS, PC A06/MF A01 |
| DOE/ER/52071- | | |
| T1 | 6:22911 | NTIS, PC A02/MF A01 |
| DOE/ER/53106- | | |
| T1 | 6:22877 | NTIS, PC A03/MF A01 |
| DOE/ET/10069- | | |
| T5 | 6:21492 | NTIS (US Sales Only) |
| DOE/ET/10340- | | |
| T3 | 6:21994 | NTIS, PC A11/MF A01 |
| T4 | 6:21995 | NTIS, PC A05/MF A01 |
| DOE/ET/10348- | | |
| T2 | 6:21996 | NTIS, PC A08/MF A01 |
| DOE/ET/10373- | | |
| T6 | 6:21997 | NTIS, PC A02/MF A01 |
| DOE/ET/10415- | | |
| T3 | 6:22240 | NTIS, PC A03/MF A01 |
| DOE/ET/10466- | | |
| T1 | 6:21542 | NTIS, PC A17/MF A01 |
| DOE/ET/10484- | | |
| T2 | 6:22459 | NTIS, PC A05/MF A01 |
| DOE/ET/10532- | | |
| T1 | 6:21493 | NTIS, PC A02/MF A01 |
| DOE/ET/10593- | | |
| T1 | 6:22414 | NTIS, PC A02/MF A01 |
| DOE/ET/10780- | | |
| T1 | 6:22144 | NTIS, PC A10/MF A01 |
| DOE/ET/11293- | | |
| T3 | 6:22154 | NTIS, PC A07/MF A01 |
| DOE/ET/11304- | | |
| T7 | 6:22157 | NTIS, PC A03/MF A01 |
| T10 | 6:22158 | NTIS, PC A06/MF A01 |
| DOE/ET/11305- | | |
| T8 | 6:22159 | NTIS, PC A04/MF A01 |
| DOE/ET/11313- | | |
| 1 | 6:21998 | NTIS, PC A05/MF A01 |
| DOE/ET/11429- | | |
| T1 | 6:21494 | NTIS, PC A08/MF A01 |
| DOE/ET/12056- | | |
| 11 | 6:21570 | NTIS, PC A06/MF A01. ORDER NUMBER DE81023779 |
| DOE/ET/12082- | | |
| 9 | 6:21571 | NTIS, PC A08/MF A01 |
| DOE/ET/12292- | | |
| T1 | 6:21999 | NTIS, PC A04/MF A01 |
| DOE/ET/12366- | | |
| 22 | 6:21572 | NTIS, PC A07/MF A01 |
| DOE/ET/12866- | | |
| 3 | 6:22241 | NTIS, PC A11/MF A01 |
| DOE/ET/13060- | | |
| T1 | 6:21535 | NTIS, PC A03/MF A01 |
| T2 | 6:21495 | NTIS, PC A10/MF A01 |
| DOE/ET/13395- | | |
| T1 | 6:21496 | NTIS, PC A03/MF A01 |
| DOE/ET/13537- | | |
| T3 | 6:21497 | NTIS, PC A07/MF A01 |
| DOE/ET/14801- | | |
| 12 | 6:21498 | NTIS, PC A04/MF A01 |
| DOE/ET/14806- | | |
| T2 | 6:21499 | NTIS, PC A04/MF A01 |
| T3 | 6:21500 | NTIS, PC A06/MF A01 |
| DOE/ET/15350- | | |
| 1 | 6:22242 | NTIS, PC A10/MF A01 |
| DOE/ET/15423- | | |
| 5 | 6:22155 | NTIS, PC A02/MF A01. Order Number DE81024987 |
| 6 | 6:22156 | NTIS, PC A02/MF A01. Order Number DE81024986 |
| DOE/ET/15426- | | |
| 4 | 6:22243 | NTIS, PC A05/MF A01 |
| DOE/ET/15518- | | |
| 3 | 6:21560 | NTIS, PC A12/MF A01 |
| 3 | 6:22145 | NTIS, PC A12/MF A01 |
| 3 | 6:22146 | NTIS, PC A12/MF A01 |
| 3 | 6:22147 | NTIS, PC A12/MF A01 |
| 3 | 6:22148 | NTIS, PC A12/MF A01 |
| DOE/ET/15602- | | |
| T4 | 6:22149 | NTIS, PC A10/MF A01 |
| DOE/ET/15619- | | |
| T1 | 6:22150 | NTIS, PC A04/MF A01 |
| DOE/ET/17091- | | |
| T1 | 6:22000 | NTIS, PC A03/MF A01 |
| DOE/ET/17103- | | |
| 2 | 6:22160 | NTIS, PC A02/MF A01 |
| DOE/ET/20071- | | |
| T4 | 6:21761 | NTIS, PC A03/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| DOE/ET/20279- | | |
| 118 | 6:21813 | NTIS, PC A02/MF A01 |
| 123 | 6:21814 | NTIS, PC A02/MF A01 |
| 128 | 6:21815 | NTIS, PC A02/MF A01 |
| 132 | 6:21816 | NTIS, PC A02/MF A01 |
| 133 | 6:21817 | NTIS, PC A02/MF A01 |
| 134 | 6:21762 | NTIS, PC A02/MF A01 |
| 135 | 6:21818 | NTIS, PC A02/MF A01 |
| 137 | 6:21940 | NTIS, PC A02/MF A01 |
| 138 | 6:21819 | NTIS, PC A02/MF A01 |
| DOE/ET/20356- | | |
| 2 | 6:21820 | NTIS, PC A04/MF A01 |
| DOE/ET/20375- | | |
| T1 | 6:21837 | NTIS, PC A15/MF A01 |
| DOE/ET/21002- | | |
| T14 | 6:21842 | NTIS, PC A02/MF A01 |
| DOE/ET/21109- | | |
| T1 | 6:21941 | NTIS, PC A09/MF A01 |
| DOE/ET/23037- | | |
| 2 | 6:21763 | NTIS, PC A02/MF A01 |
| 3 | 6:21764 | NTIS, PC A02/MF A01 |
| 4 | 6:22311 | NTIS, PC A05/MF A01 |
| DOE/ET/23151- | | |
| 80/ 1 | 6:21983 | NTIS, PC A09/MF A01 |
| DOE/ET/26214- | | |
| T1 | 6:22269 | NTIS, PC A05/MF A01 |
| DOE/ET/26716- | | |
| T1 | 6:22193 | NTIS, PC A05/MF A01 |
| DOE/ET/27087- | | |
| T1 | 6:21966 | NTIS, PC A06/MF A01 |
| DOE/ET/27111- | | |
| 2 | 6:21958 | NTIS, PC A03/MF A01 |
| DOE/ET/27163- | | |
| 1 | 6:21970 | NTIS, PC A03/MF A01 |
| 2 | 6:21965 | NTIS, PC A04/MF A01 |
| DOE/ET/27233- | | |
| T3 | 6:21977 | NTIS, PC A19/MF A01 |
| DOE/ET/28388- | | |
| T1 | 6:21959 | NTIS, PC A02/MF A01 |
| DOE/ET/29068- | | |
| T5 | 6:22012 | NTIS, PC A03/MF A01 |
| DOE/ET/32043- | | |
| T7 | 6:22153 | NTIS, PC A04/MF A01 |
| DOE/ET/34013- | | |
| T1 | 6:22046 | NTIS, PC A04/MF A01 |
| DOE/ET/35202- | | |
| T1(Vol.1) | 6:22047 | NTIS, PC A20/MF A01 |
| DOE/ET/37241- | | |
| 45 | 6:22035 | NTIS, PC A03/MF A01 |
| DOE/ET/44802- | | |
| T1 | 6:22722 | NTIS, PC A03/MF A01 |
| DOE/ET/52039- | | |
| 2 | 6:22270 | NTIS, PC A04/MF A01 |
| DOE/ET/52040- | | |
| T2 | 6:22878 | NTIS, PC A05/MF A01 |
| DOE/EV/02040- | | |
| T1 | 6:22704 | NTIS, PC A02/MF A01 |
| DOE/EV/02364- | | |
| T1 | 6:22673 | NTIS, PC A02/MF A01 |
| DOE/EV/02472- | | |
| T1 | 6:22637 | NTIS, PC A02/MF A01 |
| DOE/EV/02737- | | |
| 9 | 6:22719 | NTIS, PC A05/MF A01 |
| DOE/EV/10237- | | |
| 2 | 6:21501 | NTIS, PC A09/MF A01 |
| DOE/EV/10454- | | |
| T1 | 6:22104 | NTIS, PC A02/MF A01 |
| DOE/EV/72005- | | |
| T2 | 6:22774 | NTIS, PC A02/MF A01 |
| DOE/FC/02101- | | |
| T1 | 6:21502 | NTIS, PC A05/MF A01 |
| DOE/FC/10066- | | |
| T1(Vol.2) | 6:21543 | NTIS, PC A13/MF A01 |
| T1-(Vol.3) | 6:21487 | NTIS, PC A99/MF A01 |
| T1(Vol.4) | 6:21567 | NTIS, PC A11/MF A01 |
| T1(Vol.5) | 6:21488 | NTIS, PC A07/MF A01 |
| T1(Vol.6) | 6:21544 | NTIS, PC A03/MF A01 |
| DOE/FC/10169- | | |
| T1 | 6:21556 | NTIS, PC A07/MF A01 |
| DOE/FC/10182- | | |
| T12 | 6:22008 | NTIS, PC A03/MF A01 |
| DOE/IG- | | |
| 0008/ 1 | 6:22967 | NTIS, PC A04/MF A01 |
| DOE/IR/05106- | | |
| T6 | 6:22249 | NTIS, PC A04/MF A01 |
| T8 | 6:22250 | NTIS, PC A03/MF A01 |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| T23 | 6:22226 | NTIS, PC A03/MF A01 |
| T24 | 6:21821 | NTIS, PC A03/MF A01 |
| **DOE/JPL/954334-** | | |
| 18 | 6:21765 | NTIS, PC A05/MF A01 |
| **DOE/JPL/954739-** | | |
| 4 | 6:21766 | NTIS, PC A05/MF A01 |
| **DOE/JPL/954796-** | | |
| 81/ 12 | 6:21767 | NTIS, PC A09/MF A01 |
| **DOE/JPL/955089-** | | |
| 80/ 10 | 6:21768 | NTIS, PC A04/MF A01 |
| **DOE/JPL/955456-** | | |
| 1(Vol.1) | 6:22128 | NTIS, PC A14/MF A01 |
| 1(Vol.2) | 6:22129 | NTIS, PC A08/MF A01 |
| 1(Vol.3) | 6:22130 | NTIS, PC A03/MF A01 |
| 1(Vol.4) | 6:22131 | NTIS, PC A04/MF A01 |
| 1(Vol.5) | 6:22132 | NTIS, PC A03/MF A01 |
| **DOE/JPL/955533-** | | |
| 81/ 5 | 6:21769 | NTIS, PC A03/MF A01 |
| **DOE/JPL/955699-** | | |
| 81/ 03 | 6:21770 | NTIS, PC A03/MF A01 |
| **DOE/JPL/955733-** | | |
| 80/ 1 | 6:21771 | NTIS, PC A02/MF A01 |
| **DOE/LC/10787-** | | |
| 77 | 6:21608 | NTIS, PC A04/MF A01 |
| **DOE/LETC/RI-** | | |
| 81-1 | 6:21593 | NTIS, PC A05/MF A01 |
| **DOE/MC/08004-** | | |
| T8 | 6:21538 | NTIS, PC A02/MF A01 |
| **DOE/MC/08216-** | | |
| 157 | 6:21597 | NTIS, PC A06/MF A01 |
| **DOE/MC/14395-** | | |
| T1 | 6:22161 | NTIS, PC A02/MF A01 |
| **DOE/MC/16230-** | | |
| 152 | 6:22001 | NTIS, PC A14/MF A01 |
| 153 | 6:22002 | NTIS, PC A04/MF A01 |
| 154 | 6:22460 | NTIS, PC A07/MF A01 |
| 155 | 6:22006 | NTIS, PC A02/MF A01 |
| 156 | 6:22003 | NTIS, PC A05/MF A01 |
| **DOE/NASA/0067-** | | |
| 79-6 | 6:22162 | NTIS, PC A04/MF A01 |
| **DOE/NASA/10769-** | | |
| 16 | 6:22151 | NTIS, PC A02/MF A01 |
| **DOE/NASA/20320-** | | |
| 30 | 6:21984 | NTIS, PC A03/MF A01. Order Number DE81024946 |
| **DOE/NASA/20485-** | | |
| 8 | 6:21822 | NTIS, PC A02/MF A01 |
| **DOE/NASA/CR-** | | |
| 161724 | 6:21854 | NTIS, PC A05/MF A01 |
| 161725 | 6:21855 | NTIS, PC A06/MF A01 |
| 161726 | 6:21856 | NTIS, PC A06/MF A01 |
| 161728 | 6:21857 | NTIS, PC A06/MF A01 |
| **DOE/NDC-** | | |
| 22/ U | 6:22843 | NTIS, PC A05/MF A01 |
| **DOE/NV/00597-** | | |
| 5 | 6:21648 | NTIS, PC A10/MF A01 |
| **DOE/NWTS-** | | |
| 33(1) | 6:21665 | NTIS, PC A05/MF A01 |
| **DOE/OR/05951-** | | |
| T1 | 6:22271 | NTIS, PC A03/MF A01 |
| **DOE/OR/13511-** | | |
| T1 | 6:22051 | NTIS, PC A02/MF A01 |
| **DOE/OR/20679-** | | |
| T4 | 6:22296 | NTIS, PC A02/MF A01 |
| **DOE/PC/30072-** | | |
| T3 | 6:21503 | NTIS, PC A02/MF A01 |
| **DOE/PC/30198-** | | |
| T3 | 6:21504 | NTIS, PC A05/MF A01 |
| T4 | 6:21561 | NTIS, PC A04/MF A01 |
| T5 | 6:21505 | NTIS, PC A04/MF A01 |
| **DOE/PC/30221-** | | |
| T1 | 6:21506 | NTIS, PC A03/MF A01 |
| **DOE/PC/30227-** | | |
| T1 | 6:21507 | NTIS, PC A02/MF A01 |
| **DOE/PC/30293-** | | |
| 2 | 6:21562 | NTIS, PC A04/MF A01 |
| **DOE/PC/30303-** | | |
| T2 | 6:22441 | NTIS, PC A04/MF A01 |
| **DOE/PE/03784-** | | |
| T1 | 6:22097 | NTIS, PC A07/MF A01 |
| **DOE/PN/00293-** | | |
| T1 | 6:22057 | NTIS, PC A06/MF A01 |
| **DOE/R5/10216-** | | |
| T1 | 6:21858 | NTIS, PC A05/MF A01 |
| **DOE/RA/20222-** | | |
| T1 | 6:21508 | NTIS, PC A13/MF A01 |
| T2 | 6:21509 | NTIS, PC A10/MF A01 |
| **DOE/RA/50076-** | | |
| T3 | 6:21955 | NTIS, PC A08/MF A01 |
| **DOE/RG-** | | |
| 0059 | 6:22723 | NTIS, PC A05/MF A01. Order Number DE81024015 |
| **DOE/RG/06668-** | | |
| T1 | 6:22133 | NTIS, PC A08/MF A01 |
| **DOE/SF/00515-** | | |
| T1 | 6:22508 | NTIS, PC A03/MF A01 |
| **DOE/SF/02034-** | | |
| T14 | 6:22048 | NTIS, PC A06/MF A01 |
| **DOE/SF/10549-** | | |
| T1 | 6:21859 | NTIS, PC A08/MF A01 |
| **DOE/SF/10606-** | | |
| T1 | 6:21860 | NTIS, PC A07/MF A01 |
| **DOE/SF/10756-** | | |
| 1 | 6:21838 | NTIS, PC A13/MF A01 |
| **DOE/SR/10702-** | | |
| 1 | 6:22670 | NTIS, PC A03/MF A01 |
| **DOE/TIC-** | | |
| 8200-R43 | 6:22023 | NTIS, PC A03/MF A01 |
| 11453 | 6:22194 | NTIS, PC A05/MF A01 |
| 11454 | 6:22195 | NTIS, PC A06/MF A01 |
| 11455 | 6:22196 | NTIS, PC A09/MF A01 |
| 11456 | 6:22197 | NTIS, PC A25/MF A01 |
| 11457 | 6:22198 | NTIS, PC A11/MF A01 |
| 11459 | 6:22222 | NTIS, PC A16/MF A01 |
| 11460 | 6:22199 | NTIS, PC A10/MF A01 |
| 11461 | 6:22200 | NTIS, PC A05/MF A01 |
| 11462 | 6:22201 | NTIS, PC A05/MF A01 |
| 11463 | 6:22202 | NTIS, PC A10/MF A01 |
| 11464 | 6:22203 | NTIS, PC A02/MF A01 |
| 1015202 | 6:21555 | NTIS, PC A02/MF A01 |
| 1016824 | 6:21552 | NTIS, PC A03/MF A01 |
| 1018563 | 6:21557 | NTIS, PC A02/MF A01 |
| 1021172 | 6:21510 | NTIS, PC A02/MF A01 |
| 1021175 | 6:22251 | NTIS, PC A07/MF A01 |
| 1021731 | 6:21667 | NTIS, PC A16/MF A01 |
| 1021874 | 6:22252 | NTIS, PC A11/MF A01 |
| 1022079 | 6:22257 | NTIS, PC A03/MF A01 |
| 1022080 | 6:21668 | NTIS, PC A06/MF A01 |
| 1022096 | 6:22418 | NTIS, PC A02/MF A01 |
| 1022137 | 6:22258 | NTIS, PC A02/MF A01 |
| 1022409 | 6:22119 | NTIS, PC A08/MF A01 |
| 1022897 | 6:22253 | NTIS, PC A03/MF A01 |
| **DOE-tr-** | | |
| 73 | 6:22152 | NTIS, PC A09/MF A01 |
| **DP-MS-** | | |
| 80-84 | 6:22542 | NTIS, PC A02/MF A01 |
| 80-85 | 6:22543 | NTIS, PC A02/MF A01 |
| 80-119 | 6:22729 | NTIS, PC A04/MF A01 |
| 80-120 | 6:22054 | NTIS, PC A02/MF A01 |
| 80-123 | 6:21669 | NTIS, PC A02/MF A01 |
| 81-8 | 6:21670 | NTIS, PC A02/MF A01 |
| **DPST-** | | |
| 79-146-2S | 6:21624 | *See* GJBX-106-81 |
| 79-146-17 | 6:21637 | *See* GJBX-137(81) |
| 79-146-18 | 6:21638 | *See* GJBX-138(81) |
| **EGG-** | | |
| 1183-1797 | 6:21971 | NTIS, PC A02/MF A01 |
| 1183-1800 | 6:22442 | NTIS, PC A03/MF A01 |
| 1183-4221 | 6:22528 | NTIS, PC A04/MF A01 |
| **EGG-EA-** | | |
| 5455 | 6:22973 | NTIS, PC A04/MF A01 |
| **EGG-M-** | | |
| 00881 | 6:22074 | NTIS, PC A03/MF A01 |
| **EMD-** | | |
| 2-67-1139 | 6:21667 | *See* DOE/TIC-1021731 |
| 2-67-1139(WP) | 6:21668 | *See* DOE/TIC-1022080 |
| 81-2 | 6:22204 | General Accounting Office, Gaithersburg, MD |
| 81-35 | 6:22602 | General Accounting Office, Gaithersburg, MD |
| **ENICO-** | | |
| 1087 | 6:21671 | NTIS, PC A04/MF A01 |
| **EPA-** | | |
| 570/ 9-81-001(Vol.1) | 6:22597 | NTIS, PC A15/MF A01 |
| 570/ 9-81-001(Vol.2) | 6:22595 | *See* ORNL/EIS-192/V2 |
| 570/ 9-81-001(Vol.4) | 6:22596 | *See* ORNL/EIS-192/V4 |
| **EPA-AA-TEB-** | | |
| 81-11 | 6:22544 | Environmental Protection Agency, Office of Air, Noise and Radiation, Ann Arbor, MI |
| **EPRI-CS-** | | |
| 1760 | 6:22004 | NTIS, PC A06/MF A01 |
| **EPRI-EA-** | | |
| 1913 | 6:22545 | NTIS, PC A13/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **EPRI-EM-** | | |
| 1815 | 6:21511 | NTIS, PC A06/MF A01 |
| **EPRI-P-** | | |
| 1726-SR | 6:22106 | NTIS, PC A21/MF A01 |
| 1726-SR | 6:22134 | NTIS, PC A21/MF A01 |
| 1726-SR | 6:22135 | NTIS, PC A21/MF A01 |
| 1726-SR | 6:22136 | NTIS, PC A21/MF A01 |
| 1726-SR | 6:22137 | NTIS, PC A21/MF A01 |
| 1726-SR | 6:22461 | NTIS, PC A21/MF A01 |
| **FDA-** | | |
| 81-8042 | 6:22645 | GPO |
| 81-8042 | 6:22674 | GPO |
| 81-8042 | 6:22675 | GPO |
| 81-8042 | 6:22676 | GPO |
| 81-8042 | 6:22677 | GPO |
| 81-8042 | 6:22678 | GPO |
| 81-8042 | 6:22679 | GPO |
| 81-8042 | 6:22680 | GPO |
| 81-8042 | 6:22681 | GPO |
| 81-8042 | 6:22682 | GPO |
| 81-8042 | 6:22683 | GPO |
| 81-8042 | 6:22684 | GPO |
| 81-8042 | 6:22685 | GPO |
| 81-8042 | 6:22686 | GPO |
| 81-8042 | 6:22687 | GPO |
| 81-8042 | 6:22688 | GPO |
| 81-8042 | 6:22689 | GPO |
| 81-8042 | 6:22690 | GPO |
| 81-8042 | 6:22691 | GPO |
| 81-8042 | 6:22692 | GPO |
| 81-8042 | 6:22693 | GPO |
| **FE-** | | |
| 1806-107 | 6:21995 | *See* DOE/ET/10340-T4 |
| 2018-18 | 6:22414 | *See* DOE/ET/10593-T1 |
| 2291-48A | 6:21996 | *See* DOE/ET/10348-T2 |
| 2315-63 | 6:21493 | *See* DOE/ET/10532-T1 |
| 2341-16 | 6:22144 | *See* DOE/ET/10780-T1 |
| 2542-28(Vol.1) | 6:21535 | *See* DOE/ET/13060-T1 |
| 2542-30 | 6:21495 | *See* DOE/ET/13060-T2 |
| 2893-68 | 6:21492 | *See* DOE/ET/10069-T5 |
| 5619-1 | 6:22150 | *See* DOE/ET/15619-T1 |
| 7091-6 | 6:22000 | *See* DOE/ET/17091-T1 |
| **FERMILAB-** | | |
| 81/ 26 | 6:22552 | NTIS, PC A04/MF A01 |
| **FERMILAB-Conf-** | | |
| 80/ 64THY | 6:22824 | NTIS, PC A07/MF A01 |
| **FSEC-CR-** | | |
| 81014(DO) | 6:21736 | *See* DOE/CS/30278-T4 |
| **FWS/OBS-** | | |
| 80/ 41 | 6:22572 | GPO |
| **GA-A-** | | |
| 16239 | 6:22049 | NTIS, PC A06/MF A01 |
| 16262 | 6:22050 | NTIS, PC A02/MF A01 |
| **GEND-** | | |
| 002 | 6:22075 | NTIS, PC A22/MF A01 |
| 007 | 6:22076 | NTIS, PC A03/MF A01 |
| 016 | 6:22026 | NTIS, PC A07/MF A01 |
| **GEPP-TIS-** | | |
| 569 | 6:22327 | NTIS, PC A02/MF A01 |
| **GJBX-** | | |
| 35((81) (Vol.2) (PriceSalina) | 6:21620 | NTIS, PC A99/MF A01 |
| 69(81) | 6:21621 | NTIS, PC A06/MF A01 |
| 80(81) | 6:21622 | NTIS, PC A07/MF A01 |
| 93(81) | 6:21623 | NTIS, PC E17/MF, $20.15 |
| 106-81 | 6:21624 | NTIS, PC E01/MF, $3.50 |
| 110-81 | 6:21625 | NTIS, PC E06/MF, $3.50 |
| 111(81) | 6:21626 | NTIS, PC E14/MF, $9.65 |
| 112(81) | 6:21627 | NTIS, PC E15/MF, $18.65 |
| 117(81) | 6:21628 | NTIS, PC E13/MF, $13.40 |
| 135-81(Vol.1) | 6:21629 | PCE 13/MF, $23.90 |
| 135-81(Vol.2A) | 6:21630 | NTIS, PC A06/MF A01 |
| 135-81(Vol.2B) | 6:21631 | NTIS, PC A08/MF A01 |
| 135-81(Vol.2C) | 6:21632 | NTIS, PC A07/MF A01 |
| 135-81(Vol.2D) | 6:21633 | NTIS, PC A05/MF A01 |
| 136-81(Vol.1) | 6:21634 | NTIS, PC E09/MF, $15.10 |
| 136-81(Vol.2A) | 6:21635 | NTIS, PC A08/MF A01 |
| 136-81(Vol.2B) | 6:21636 | NTIS, PC A09/MF A01 |
| 137(81) | 6:21637 | NTIS, PC E02/MF, $3.50 |
| 138(81) | 6:21638 | NTIS, PC E03/MF, $3.50 |
| 141(81) | 6:21639 | NTIS, PC A12/MF A01 |
| 144(81) | 6:21640 | NTIS, PC A08/MF A01 |
| 145(81) | 6:21641 | NTIS, PC E10/MF, $3.50 |
| **GSRMP-** | | |
| 10 | 6:21969 | *See* LBL-12392 |
| **HEDL-SA-** | | |
| 2044 | 6:22059 | NTIS, PC A02/MF A01 |
| 2175 | 6:22036 | NTIS, PC A02/MF A01 |
| 2244-FP | 6:22077 | NTIS, PC A02/MF A01 |
| 2244-S | 6:22078 | NTIS, PC A02/MF A01 |
| 2253 | 6:22912 | NTIS, PC A02/MF A01 |
| 2275-FP | 6:22060 | NTIS, PC A02/MF A01 |
| 2278-FP | 6:22061 | NTIS, PC A02/MF A01 |
| **HEDL-TME-** | | |
| 80-85 | 6:22027 | NTIS, PC A07/MF A01 |
| **HNEI-** | | |
| 81-01 | 6:21980 | Hawaii Natural Energy Institute, Manoa |
| **ICTIS/TR-** | | |
| 13 | 6:21545 | NTIS (US Sales Only), PC A06/ MF A01 |
| **IDO-** | | |
| 22060 | 6:22594 | NTIS, PC A05/MF A01 |
| **K/UR-** | | |
| 147 | 6:21641 | *See* GJBX-145(81) |
| **LA-** | | |
| 8295-MS | 6:22205 | NTIS, PC A05/MF A01 |
| 8397-PR | 6:21607 | NTIS, PC A03/MF A01 |
| 8744-MS | 6:21609 | NTIS, PC A02/MF A01 |
| 8797-PR | 6:21861 | NTIS, PC A05/MF A01 |
| 8797-PR | 6:21942 | NTIS, PC A05/MF A01 |
| 8797-PR | 6:21943 | NTIS, PC A05/MF A01 |
| 8797-PR | 6:22037 | NTIS, PC A05/MF A01 |
| 8797-PR | 6:22043 | NTIS, PC A05/MF A01 |
| 8797-PR | 6:22044 | NTIS, PC A05/MF A01 |
| 8797-PR | 6:22052 | NTIS, PC A05/MF A01 |
| 8797-PR | 6:22079 | NTIS, PC A05/MF A01 |
| 8797-PR | 6:22419 | NTIS, PC A05/MF A01 |
| 8799-MS | 6:22860 | NTIS, PC A02/MF A01 |
| 8801-MS | 6:21956 | NTIS, PC A04/MF A01 |
| 8809-MS | 6:21694 | NTIS, PC A03/MF A01 |
| 8811-PR | 6:21691 | NTIS, PC A03/MF A01 |
| **LA-tr-** | | |
| 80-10 | 6:22480 | NTIS, PC A17/MF A01 |
| **LA-UR-** | | |
| 80-3095 | 6:21752 | NTIS, PC A03/MF A01 |
| 81-317 | 6:22080 | NTIS, PC A02/MF A01 |
| 81-813 | 6:22227 | NTIS, PC A02/MF A01 |
| 81-965 | 6:22739 | NTIS, PC A02/MF A01 |
| 81-966 | 6:22740 | NTIS, PC A02/MF A01 |
| 81-992 | 6:22522 | NTIS, PC A02/MF A01 |
| 81-1028 | 6:22879 | NTIS, PC A02/MF A01 |
| 81-1038 | 6:22420 | NTIS, PC A02/MF A01 |
| 81-1039 | 6:21862 | NTIS, PC A02/MF A01 |
| 81-1067 | 6:22523 | NTIS, PC A02/MF A01 |
| 81-1074 | 6:22519 | NTIS, PC A02/MF A01 |
| 81-1082 | 6:22974 | NTIS, PC A02/MF A01 |
| 81-1084 | 6:22421 | NTIS, PC A02/MF A01 |
| 81-1092 | 6:21961 | NTIS, PC A02/MF A01 |
| 81-1126 | 6:22520 | NTIS, PC A02/MF A01 |
| 81-1148 | 6:22880 | NTIS, PC A02/MF A01 |
| 81-1157 | 6:22775 | NTIS, PC A02/MF A01 |
| 81-1166 | 6:22705 | NTIS, PC A02/MF A01 |
| 81-1175 | 6:22556 | NTIS, PC A03/MF A01 |
| 81-1192 | 6:22975 | NTIS, PC A02/MF A01 |
| 81-1196 | 6:21616 | NTIS, PC A02/MF A01 |
| 81-1201 | 6:21746 | NTIS, PC A02/MF A01 |
| 81-1228 | 6:22776 | NTIS, PC A02/MF A01 |
| 81-1229 | 6:22913 | NTIS, PC A02/MF A01 |
| 81-1232 | 6:22434 | NTIS, PC A02/MF A01 |
| 81-1245 | 6:22914 | NTIS, PC A02/MF A01 |
| 81-1270 | 6:22524 | NTIS, PC A03/MF A01 |
| 81-1316 | 6:22422 | NTIS, PC A02/MF A01 |
| 81-1324 | 6:22485 | NTIS, PC A02/MF A01 |
| 81-1385 | 6:21672 | NTIS, PC A02/MF A01 |
| 81-1394 | 6:22915 | NTIS, PC A02/MF A01 |
| 81-1400 | 6:22273 | NTIS, PC A02/MF A01 |
| 81-1402 | 6:21695 | NTIS, PC A02/MF A01 |
| 81-1404 | 6:22916 | NTIS, PC A02/MF A01 |
| 81-1408 | 6:22917 | NTIS, PC A02/MF A01 |
| 81-1430 | 6:21972 | NTIS, PC A02/MF A01 |
| 81-1435 | 6:22881 | NTIS, PC A02/MF A01 |
| 81-1443 | 6:22312 | NTIS, PC A02/MF A01 |
| 81-1510 | 6:21696 | NTIS, PC A02/MF A01 |
| 81-1511 | 6:22328 | NTIS, PC A02/MF A01 |
| 81-1512 | 6:21697 | NTIS, PC A03/MF A01 |
| 81-1526 | 6:22329 | NTIS, PC A03/MF A01 |
| 81-1555 | 6:22854 | NTIS, PC A02/MF A01 |
| 81-1565 | 6:22435 | NTIS, PC A02/MF A01 |
| 81-1567 | 6:22436 | NTIS, PC A02/MF A01 |
| 81-1640 | 6:22486 | NTIS, PC A02/MF A01 |
| 81-1643 | 6:22423 | NTIS, PC A02/MF A01 |
| 1461 | 6:22330 | NTIS, PC A02/MF A01 |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **LBL-** | | |
| 11197 | 6:21617 | NTIS, PC A02/MF A01 |
| 11214 | 6:21615 | NTIS, PC A03/MF A01 |
| 11580 | 6:22468 | NTIS, PC A02/MF A01 |
| 11588 | 6:22844 | NTIS, PC A11/MF A01 |
| 11701 | 6:22206 | NTIS, PC A02/MF A01 |
| 11709 | 6:22487 | NTIS, PC A02/MF A01 |
| 11713 | 6:22488 | NTIS, PC A02/MF A01 |
| 11715 | 6:22489 | NTIS, PC A02/MF A01 |
| 11719 | 6:22490 | NTIS, PC A02/MF A01 |
| 11725 | 6:22491 | NTIS, PC A02/MF A01 |
| 11726 | 6:22469 | NTIS, PC A02/MF A01 |
| 11940 | 6:21967 | NTIS, PC A02/MF A01 |
| 12102 | 6:22090 | NTIS, PC A04/MF A01 |
| 12127 | 6:22364 | NTIS, PC A02/MF A01 |
| 12128 | 6:21596 | NTIS, PC A02/MF A01 |
| 12141 | 6:22415 | NTIS, PC A02/MF A01 |
| 12146 | 6:21727 | NTIS, PC A02/MF A01 |
| 12157 | 6:22777 | NTIS, PC A09/MF A01 |
| 12157 | 6:22778 | NTIS, PC A09/MF A01 |
| 12157 | 6:22779 | NTIS, PC A09/MF A01 |
| 12157 | 6:22780 | NTIS, PC A09/MF A01 |
| 12157 | 6:22781 | NTIS, PC A09/MF A01 |
| 12157 | 6:22782 | NTIS, PC A09/MF A01 |
| 12157 | 6:22783 | NTIS, PC A09/MF A01 |
| 12157 | 6:22784 | NTIS, PC A09/MF A01 |
| 12157 | 6:22785 | NTIS, PC A09/MF A01 |
| 12174 | 6:21960 | NTIS, PC A04/MF A01 |
| 12175 | 6:21968 | NTIS, PC A04/MF A01 |
| 12214 | 6:22416 | NTIS, PC A02/MF A01 |
| 12215 | 6:22465 | NTIS, PC A04/MF A01 |
| 12350 | 6:22990 | NTIS, PC A02/MF A01 |
| 12392 | 6:21969 | NTIS, PC A09/MF A01 |
| 12445 | 6:22091 | NTIS, PC A02/MF A01 |
| 12478 | 6:21673 | NTIS, PC A02/MF A01 |
| 12511 | 6:22730 | NTIS, PC A02/MF A01 |
| 12514 | 6:22092 | NTIS, PC A07/MF A01 |
| 12539 | 6:22546 | NTIS, PC A02/MF A01 |
| 12540 | 6:22532 | NTIS, PC A02/MF A01 |
| 12548 | 6:22264 | NTIS, PC A04/MF A01 |
| 12548 | 6:22274 | NTIS, PC A04/MF A01 |
| 12548 | 6:22275 | NTIS, PC A04/MF A01 |
| 12548 | 6:22297 | NTIS, PC A04/MF A01 |
| 12548 | 6:22298 | NTIS, PC A04/MF A01 |
| 12548 | 6:22299 | NTIS, PC A04/MF A01 |
| 12548 | 6:22300 | NTIS, PC A04/MF A01 |
| 12548 | 6:22301 | NTIS, PC A04/MF A01 |
| 12548 | 6:22302 | NTIS, PC A04/MF A01 |
| 12548 | 6:22313 | NTIS, PC A04/MF A01 |
| 12548 | 6:22724 | NTIS, PC A04/MF A01 |
| 12552 | 6:22492 | NTIS, PC A02/MF A01 |
| 12555 | 6:22694 | NTIS, PC A03/MF A01 |
| 12626 | 6:22786 | NTIS, PC A11/MF A01 |
| **MCR-** | | |
| 81-543 | 6:21863 | NTIS, PC A09/MF A01 |
| **MDC-G-** | | |
| 8163A | 6:21864 | NTIS, PC A03/MF A01 |
| **METC/EGSP-** | | |
| 14 | 6:21598 | NTIS, PC A02/MF A01 |
| 816 | 6:21599 | NTIS, PC A02/MF A01 |
| **MHSMP-** | | |
| 81-25 | 6:22525 | NTIS, PC A02/MF A01 |
| **MIT-EL-** | | |
| 80-014 | 6:21651 | NTIS, PC A09/MF A01 |
| **MLM-** | | |
| 2826 | 6:22424 | NTIS, PC A03/MF A01 |
| **MRI-** | | |
| 81-R1805 | 6:22008 | *See* DOE/FC/10182-T12 |
| **NASA-TM-** | | |
| 81719 | 6:21984 | *See* DOE/NASA/20320-30 |
| 81738 | 6:21822 | *See* DOE/NASA/20485-8 |
| 81775 | 6:22151 | *See* DOE/NASA/10769-16 |
| **NBS-TN-** | | |
| 1134 | 6:21944 | NTIS, PC A05/MF A01 |
| **NCEI-** | | |
| 0024 | 6:22254 | NTIS |
| **NCSC-TM-** | | |
| 298-80 | 6:21841 | *See* DOE/CH/00135-3 |
| **NE-E-** | | |
| 15-2NB-T(Rev.) (1-81) | 6:22045 | Nuclear Standards Management Center, Oak Ridge, TN |
| **NE-M-** | | |
| 2-6T(4-81) (Rev.) | 6:22284 | Nuclear Standards Management Center, Oak Ridge, TN |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **NP-** | | |
| 1902437 | 6:22108 | Manoa, Hawaii; Univ. of Hawaii (1980). |
| 1902447 | 6:22005 | Publications Office, Washington, DC |
| 1902507 | 6:22168 | Sacramento, CA; SolarCal Council ([nd]). |
| 1902508 | 6:22223 | Sacramento, CA; SolarCal ([nd]). |
| 1902509 | 6:21750 | Sacramento, CA; SolarCal ([nd]). |
| 1902510 | 6:22111 | Sacramento, CA; Solarcal Council ([nd]). |
| 1902593 | 6:22207 | NTIS (US Sales Only), PC A03/MF A01 |
| 1902598 | 6:22245 | NTIS (US Sales Only), PC A02/MF A01 |
| 1902600 | 6:21865 | NTIS (US Sales Only), PC A04/MF A01 |
| 1902603 | 6:22220 | Nashville, TN; Tennessee Energy Authority (1980). |
| 1902615 | 6:22126 | Cambridge, MA; National Bureau of Economic Research (1980). |
| 1902616 | 6:21589 | Cambridge, MA; National Bureau of Economic Research (1980). |
| 1902629 | 6:21588 | Washington, DC; Congressional Budget Office (1981). |
| 1902707 | 6:21606 | Washington, DC; National Petroleum Council (1980). |
| **NUREG-** | | |
| 75/ 025 | 6:22605 | Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0511 |
| 0702 | 6:22608 | Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0789 |
| **NVO-** | | |
| 196-21 | 6:21674 | NTIS, PC A05/MF A01 |
| **NYSERDA-** | | |
| 80-21 | 6:21728 | New York State Energy Research and Development Authority, Albany, NY |
| 80-26 | 6:22208 | New York State Energy Research and Development Authority, Albany, NY |
| **ONWI-** | | |
| 9(3) (1980) | 6:21675 | NTIS, PC A19/MF A01 |
| 75 | 6:21676 | NTIS, PC A09/MF A01 |
| 124 | 6:21677 | NTIS, PC A07/MF A01 |
| 189 | 6:21649 | NTIS, PC A04/MF A01 |
| 203 | 6:21678 | NTIS, PC A07/MF A01 |
| 234 | 6:21679 | NTIS, PC A09/MF A01 |
| **ORAU/IEA-** | | |
| 81-1(M) | 6:22167 | NTIS, PC A11/MF A01 |
| 81-3(M) | 6:21591 | NTIS, PC A03/MF A01 |
| 81-4(M) | 6:22081 | NTIS, PC A04/MF A01 |
| **ORNL-** | | |
| 5711 | 6:22038 | NTIS, PC A15/MF A01 |
| 5738 | 6:22332 | NTIS, PC A08/MF A01 |
| 5738 | 6:22333 | NTIS, PC A08/MF A01 |
| 5738 | 6:22334 | NTIS, PC A08/MF A01 |
| 5738 | 6:22335 | NTIS, PC A08/MF A01 |
| 5746 | 6:22120 | NTIS, PC A11/MF A01 |
| **ORNL/CSD/TM-** | | |
| 141 | 6:22099 | NTIS, PC E07/, $3.50 |
| **ORNL/EIS-** | | |
| 192/ V2 | 6:22595 | NTIS, PC A99/MF A01 |
| 192/ V4 | 6:22596 | NTIS, PC A24/MF A01 |
| 192(Vol.1) | 6:22597 | *See* EPA-570/9-81-001(Vol.1) |
| **ORNL/FMP-** | | |
| 81/ 1 | 6:21513 | NTIS, PC A18/MF A01 |
| **ORNL/MIT-** | | |
| 326 | 6:21514 | NTIS, PC A04/MF A01 |
| 327 | 6:21539 | NTIS, PC A04/MF A01 |
| **ORNL/Sub-** | | |
| 81/ 13800/ 1 | 6:22209 | NTIS, PC A07/MF A01 |
| 7715/ 4 | 6:22210 | NTIS, PC A02/MF A01 |
| **ORNL/TM-** | | |
| 7199 | 6:22121 | NTIS, PC A04/MF A01 |
| 7533 | 6:21515 | NTIS, PC A03/MF A01 |
| 7714 | 6:22039 | NTIS, PC A04/MF A01 |
| 7715 | 6:22040 | NTIS, PC A04/MF A01 |
| 7779 | 6:22088 | NTIS, PC A05/MF A01 |
| 7819 | 6:22065 | NTIS, PC A02/MF A01 |
| **ORNL-tr-** | | |
| 4735 | 6:21643 | NTIS, PC A02/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 4735 | 6:21643 | NTIS, PC A02/MF A01 |
| 4750 | 6:22864 | NTIS, PC A02/MF A01 |
| **ORO-** | | |
| 5127-1 | 6:22239 | *See* DOE/CS/40183-T1 |
| **P-** | | |
| 400-80-036 | 6:22211 | California Energy Commission, Sacramento, CA |
| 500-79-014 | 6:21737 | *See* DOE/EIA/10189-T1 |
| **PATENTS-US-** | | (US: Commissioner of Patents, Washington, D.C. 20231, USA, $.50 per copy. Government Patent Applications available from NTIS) |
| A 141,508 | 6:22696 | |
| **PEP-NOTE-** | | |
| 341 | 6:22495 | *See* SLAC-PUB-2677 |
| 345 | 6:22474 | *See* SLAC-PUB-2678 |
| 347 | 6:22497 | *See* SLAC-PUB-2684 |
| 348 | 6:22477 | *See* SLAC-PUB-2690 |
| 349 | 6:22475 | *See* SLAC-PUB-2683 |
| 351 | 6:22471 | *See* SLAC-PUB-2670 |
| 355 | 6:22476 | *See* SLAC-PUB-2688 |
| 356 | 6:22499 | *See* SLAC-PUB-2691 |
| **PNL-** | | |
| 3312 | 6:22212 | NTIS, PC A16/MF A01 |
| 3435 | 6:21978 | NTIS, PC A05/MF A01 |
| 3702 | 6:21680 | NTIS, PC A04/MF A01 |
| 3719 | 6:22255 | NTIS, PC A05/MF A01 |
| 3739 | 6:21985 | NTIS, PC A07/MF A01 |
| 3746 | 6:22089 | NTIS, PC A09/MF A01 |
| 3817 | 6:21692 | NTIS, PC A04/MF A01 |
| **PNL-SA-** | | |
| 8797 | 6:22425 | NTIS, PC A02/MF A01 |
| 8812 | 6:21516 | NTIS, PC A03/MF A01 |
| 9092 | 6:21681 | NTIS, PC A03/MF A01 |
| 9096 | 6:22725 | NTIS, PC A03/MF A01 |
| 9197 | 6:22660 | NTIS, PC A03/MF A01 |
| 9231 | 6:21682 | NTIS, PC A02/MF A01 |
| 9333 | 6:22861 | NTIS, PC A03/MF A01 |
| 9464 | 6:21772 | NTIS, PC A03/MF A01 |
| **PPPL-** | | |
| 1774 | 6:22882 | NTIS, PC A04/MF A01 |
| 1781 | 6:22883 | NTIS, PC A02/MF A01 |
| 1783 | 6:22884 | NTIS, PC A02/MF A01 |
| 1790 | 6:22918 | NTIS, PC A02/MF A01 |
| 1791 | 6:22885 | NTIS, PC A02/MF A01 |
| 1792 | 6:22886 | NTIS, PC A03/MF A01 |
| **PSI-TR-** | | |
| 259 | 6:21562 | *See* DOE/PC/30293-2 |
| **RFP-** | | |
| 3049 | 6:22277 | NTIS, PC A02/MF A01 |
| **RHO-CD-** | | |
| 972 | 6:21683 | NTIS, PC A09/MF A01 |
| **RHO-SA-** | | |
| 218 | 6:22336 | NTIS, PC A03/MF A01 |
| **RRA-T-** | | |
| 8012 | 6:21639 | *See* GJBX-141(81) |
| **SAI-** | | |
| 444-80-299-LJ | 6:22213 | NTIS, PC A06/MF A01 |
| **SAND-** | | |
| 80-0216 | 6:21773 | NTIS, PC A02/MF A01 |
| 80-1583 | 6:21945 | NTIS, PC A05/MF A01 |
| 80-1880C | 6:22526 | NTIS, PC A02/MF A01 |
| 80-1987 | 6:22426 | NTIS, PC A03/MF A01 |
| 80-2016 | 6:21684 | NTIS, PC A02/MF A01 |
| 80-2096 | 6:21685 | NTIS, PC A02/MF A01 |
| 80-2206C | 6:21774 | NTIS, PC A02/MF A01 |
| 80-2549C | 6:22427 | NTIS, PC A02/MF A01 |
| 80-2669 | 6:21986 | NTIS, PC A03/MF A01 |
| 80-2776 | 6:21987 | NTIS, PC A02/MF A01 |
| 80-2871 | 6:21594 | NTIS, PC A03/MF A01 |
| 80-7140 | 6:21595 | NTIS, PC A11/MF A01 |
| 81-0048 | 6:21747 | NTIS, PC A03/MF A01 |
| 81-0069 | 6:21775 | NTIS, PC A03/MF A01 |
| 81-0101C | 6:21573 | NTIS, PC A02/MF A01 |
| 81-0113 | 6:21839 | NTIS, PC A03/MF A01 |
| 81-0126C | 6:22518 | NTIS, PC A03/MF A01 |
| 81-0147C | 6:22278 | NTIS, PC A03/MF A01 |
| 81-0196 | 6:22521 | NTIS, PC A04/MF A01 |
| 81-0203C | 6:22787 | NTIS, PC A02/MF A01 |
| 81-0225 | 6:21603 | NTIS, PC A04/MF A01 |
| 81-0290 | 6:21946 | NTIS, PC A08/MF A01 |
| 81-0313 | 6:21947 | NTIS, PC A02/MF A01 |
| 81-0331C | 6:22337 | NTIS, PC A02/MF A01 |
| 81-0385 | 6:21948 | NTIS, PC A04/MF A01 |
| 81-0482 | 6:22744 | NTIS, PC A05/MF A01 |
| 81-0483 | 6:22745 | NTIS, PC A09/MF A01 |
| 81-0495C | 6:21698 | NTIS, PC A02/MF A01 |
| 81-0558C | 6:22279 | NTIS, PC A02/MF A01 |
| 81-0605C | 6:21650 | NTIS, PC A02/MF A01 |
| 81-0658C | 6:22456 | NTIS, PC A02/MF A01 |
| 81-0662 | 6:21954 | NTIS, PC A06/MF A01 |
| 81-0691C | 6:22976 | NTIS, PC A02/MF A01 |
| 81-0703 | 6:21604 | NTIS, PC A02/MF A01 |
| 81-0749C | 6:22062 | NTIS, PC A02/MF A01 |
| 81-0897 | 6:21823 | NTIS, PC A04/MF A01 |
| 81-0994 | 6:22977 | NTIS, PC A03/MF A01 |
| 81-1038 | 6:21610 | NTIS, PC A04/MF A01 |
| 81-1069C | 6:21546 | NTIS, PC A02/MF A01 |
| 81-1108C | 6:21988 | NTIS, PC A02/MF A01 |
| 81-1145C | 6:21776 | NTIS, PC A02/MF A01 |
| 81-1191C | 6:21777 | NTIS, PC A02/MF A01 |
| 81-1193C | 6:21824 | NTIS, PC A02/MF A01 |
| 81-1211C | 6:21778 | NTIS, PC A02/MF A01 |
| 81-1222C | 6:21779 | NTIS, PC A02/MF A01 |
| 81-7063 | 6:22731 | NTIS, PC A07/MF A01 |
| 81-7066 | 6:21973 | NTIS, PC A05/MF A01 |
| 81-7113C | 6:21780 | NTIS, PC A02/MF A01 |
| 81-7115C | 6:22093 | NTIS, PC A02/MF A01 |
| 81-7116C | 6:22094 | NTIS, PC A02/MF A01 |
| 81-7119C | 6:22095 | NTIS, PC A02/MF A01 |
| 81-8642 | 6:22259 | NTIS, PC A02/MF A01 |
| **SERI/PR-** | | |
| 8041-16-T1 | 6:21781 | NTIS, PC A03/MF A01 |
| 8063-1-T1 | 6:21782 | NTIS, PC A04/MF A01 |
| 8063-1-T3 | 6:21783 | NTIS, PC A03/MF A01 |
| 8063-1-T4 | 6:21784 | NTIS, PC A04/MF A01 |
| 8309-1-T4 | 6:21785 | NTIS, PC A06/MF A01 |
| 9190-1-T1 | 6:21786 | NTIS, PC A03/MF A01 |
| 9219-T1 | 6:21787 | NTIS, PC A03/MF A01 |
| 9234-2-T1 | 6:21788 | NTIS, PC A03/MF A01 |
| 9237-1-T2 | 6:21789 | NTIS, PC A03/MF A01 |
| 9354-T1 | 6:21790 | NTIS, PC A03/MF A01 |
| 9372-1-T1 | 6:21791 | NTIS, PC A05/MF A01 |
| 80062-1-T1 | 6:21792 | NTIS, PC A03/MF A01 |
| **SERI/TP-** | | |
| 612-1190 | 6:21793 | NTIS, PC A02/MF A01 |
| **SERI/TR-** | | |
| 434-423 | 6:21753 | NTIS, PC A04/MF A01 |
| 634-1011 | 6:21843 | NTIS, PC A09/MF A01 |
| 731-587 | 6:21949 | NTIS, PC A03/MF A01 |
| 8063-1-T2 | 6:21794 | NTIS, PC A07/MF A01 |
| 98174-1 | 6:21729 | NTIS, PC A06/MF A01 |
| 98175-1 | 6:21730 | NTIS, PC A08/MF A01 |
| **SLAC-PUB-** | | |
| 2664 | 6:22493 | NTIS, PC A02/MF A01 |
| 2666 | 6:22470 | NTIS, PC A02/MF A01 |
| 2670 | 6:22471 | NTIS, PC A02/MF A01 |
| 2672 | 6:22472 | NTIS, PC A02/MF A01 |
| 2673 | 6:22473 | NTIS, PC A02/MF A01 |
| 2674 | 6:22825 | NTIS, PC A02/MF A01 |
| 2675 | 6:22494 | NTIS, PC A02/MF A01 |
| 2677 | 6:22495 | NTIS, PC A02/MF A01 |
| 2678 | 6:22474 | NTIS, PC A02/MF A01 |
| 2682 | 6:22496 | NTIS, PC A02/MF A01 |
| 2683 | 6:22475 | NTIS, PC A02/MF A01 |
| 2684 | 6:22497 | NTIS, PC A02/MF A01 |
| 2688 | 6:22476 | NTIS, PC A02/MF A01 |
| 2689 | 6:22498 | NTIS, PC A02/MF A01 |
| 2690 | 6:22477 | NTIS, PC A02/MF A01 |
| 2691 | 6:22499 | NTIS, PC A02/MF A01 |
| 2698 | 6:22500 | NTIS, PC A02/MF A01 |
| 2700 | 6:22478 | NTIS, PC A05/MF A01 |
| 2701 | 6:22501 | NTIS, PC A02/MF A01 |
| 2702 | 6:22502 | NTIS, PC A02/MF A01 |
| 2703 | 6:22503 | NTIS, PC A02/MF A01 |
| 2704 | 6:22504 | NTIS, PC A02/MF A01 |
| **SOLAR/0005-** | | |
| 81/ 80 | 6:21866 | NTIS, PC A04/MF A01 |
| 81/ 80 | 6:21867 | NTIS, PC A04/MF A01 |
| 81/ 80 | 6:21868 | NTIS, PC A04/MF A01 |
| 81/ 80 | 6:21869 | NTIS, PC A04/MF A01 |
| 81/ 80 | 6:21870 | NTIS, PC A04/MF A01 |
| 81/ 80 | 6:21871 | NTIS, PC A04/MF A01 |
| 81/ 80 | 6:21872 | NTIS, PC A04/MF A01 |
| 81/ 80 | 6:21873 | NTIS, PC A04/MF A01 |
| **SOLAR/0010-** | | |
| 81/ 04 | 6:21741 | NTIS, PC A09/MF A01 |
| **SOLAR/1025-** | | |
| 81/ 50 | 6:21874 | NTIS, PC A04/MF A01 |
| **SOLAR/1039-** | | |
| 81/ 14 | 6:21875 | NTIS, PC A05/MF A01 |
| **SOLAR/1044-** | | |
| 80/ 50 | 6:21935 | NTIS, PC A04/MF A01 |

| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **SOLAR/1050-** | | |
| 81/ 14 | 6:21876 | NTIS, PC A05/MF A01 |
| **TAC/SP-** | | |
| 80-004 | 6:21795 | Univ. of New Mexico, Albuquerque |
| **TIS-** | | |
| 6105 | 6:21991 | *See* CONF-790145-4 |
| **TVA/OP/PINF-** | | |
| 81/ 2 | 6:22138 | NTIS, PC A04/MF A01 |
| **UCAR-** | | |
| 10060-80-3 | 6:22887 | NTIS, PC A06/MF A01 |
| **UCI-** | | |
| 18966 | 6:22028 | NTIS, PC A02/MF A01 |
| **UCID-** | | |
| 18286 | 6:22463 | NTIS, PC A02/MF A01 |
| 18509-80-1 | 6:22394 | NTIS, PC A02/MF A01 |
| 18649 | 6:22978 | NTIS, PC A03/MF A01 |
| 18893 | 6:21877 | NTIS, PC A02/MF A01 |
| 18983 | 6:22919 | NTIS, PC A02/MF A01 |
| 19024 | 6:22866 | NTIS, PC A03/MF A01 |
| 19029 | 6:22265 | NTIS, PC A05/MF A01 |
| 19034 | 6:21686 | NTIS, PC A04/MF A01 |
| 19040 | 6:22547 | NTIS, PC A02/MF A01 |
| 19045 | 6:21611 | NTIS, PC A02/MF A01 |
| 19047 | 6:22732 | NTIS, PC A04/MF A01 |
| 19049 | 6:22428 | NTIS, PC A02/MF A01 |
| 19055 | 6:22859 | NTIS, PC A03/MF A01 |
| 30183 | 6:22979 | NTIS, PC A02/MF A01 |
| **UCRL-** | | |
| 15327 | 6:22788 | NTIS, PC A03/MF A01 |
| 15334 | 6:22527 | NTIS, PC A04/MF A01 |
| 15345 | 6:22082 | NTIS, PC A03/MF A01 |
| 15346 | 6:22980 | NTIS, PC A04/MF A01 |
| 15347 | 6:21687 | NTIS, PC A08/MF A01 |
| 50026-80-4 | 6:21517 | NTIS, PC A04/MF A01 |
| 52000-81-6 | 6:22920 | NTIS, PC A03/MF A01 |
| 52434(Vol.8) | 6:22306 | NTIS, PC A02/MF A01 |
| 52934 | 6:22529 | NTIS, PC A03/MF A01 |
| 53099 | 6:22888 | NTIS, PC E03/MF, $3.50 |
| 83764 | 6:22789 | NTIS, PC A03/MF A01 |
| 83791(Rev.1) | 6:22981 | NTIS, PC A02/MF A01 |
| 83992 | 6:22457 | NTIS, PC A02/MF A01 |
| 83993 | 6:22505 | NTIS, PC A02/MF A01 |
| 84347 | 6:22087 | NTIS, PC A02/MF A01 |
| 84475(Rev.1) | 6:21719 | NTIS, PC A02/MF A01 |
| 84691 | 6:22443 | NTIS, PC A02/MF A01 |
| 84875(Rev.1) | 6:22429 | NTIS, PC A02/MF A01 |
| 84876(Rev.1) | 6:22430 | NTIS, PC A02/MF A01 |
| 84964 | 6:22982 | NTIS, PC A02/MF A01 |
| 84965 | 6:22983 | NTIS, PC A04/MF A01 |
| 84966 | 6:22984 | NTIS, PC A02/MF A01 |
| 84968 | 6:22431 | NTIS, PC A02/MF A01 |
| 85016 | 6:22432 | NTIS, PC A02/MF A01 |
| 85140 | 6:21720 | NTIS, PC A02/MF A01 |
| 85254 | 6:22448 | NTIS, PC A02/MF A01 |
| 85310 | 6:22985 | NTIS, PC A02/MF A01 |
| 85331(Rev.1) | 6:21605 | NTIS, PC A02/MF A01 |
| 85337 | 6:22444 | NTIS, PC A02/MF A01 |
| 85354 | 6:22445 | NTIS, PC A02/MF A01 |
| 85366 | 6:22446 | NTIS, PC A02/MF A01 |
| 85409 | 6:21731 | NTIS, PC A02/MF A01 |
| 85411 | 6:22726 | NTIS, PC A02/MF A01 |
| 85577 | 6:22790 | NTIS, PC A03/MF A01 |
| 85577(Rev.1) | 6:22791 | NTIS, PC A03/MF A01 |
| 85707 | 6:22083 | NTIS, PC A02/MF A01 |
| 85730 | 6:22530 | NTIS, PC A02/MF A01 |
| 85743 | 6:21722 | NTIS, PC A02/MF A01 |
| 85845 | 6:21612 | NTIS, PC A02/MF A01 |
| 85858 | 6:22792 | NTIS, PC A02/MF A01 |
| 85958 | 6:22533 | NTIS, PC A02/MF A01 |
| **UCRL-Trans-** | | |
| 11663 | 6:22863 | NTIS, PC A02/MF A01 |
| 11676 | 6:22293 | NTIS, PC A02/MF A01 |
| **UMTA-NY-** | | |
| 06-0048-81-1 | 6:22228 | NTIS |
| **UR-** | | |
| 3490/ LCP-22 | 6:22631 | NTIS, PC A10/MF A01 |
| **USDA-REA-EIS(ADM)-** | | |
| 79-1-F | 6:22606 | Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0792 |
| 80-4-F | 6:22607 | Information Resources Press, 2100 M Street, NW, Suite 316, Washington, DC. (MF or HC) Order No. 80-0790 |
| **USGS-OFR-** | | |
| 79-1248 | 6:21962 | Geological Survey, Washington, DC |
| 79-1307 | 6:21963 | Geological Survey, Washington, DC |
| 79-1467 | 6:21964 | Geological Survey, Washington, DC |
| 80-490 | 6:21957 | Geological Survey, Washington, DC |
| 810526 | 6:22594 | *See* IDO-22060 |
| **WAOENG-** | | |
| 80-17 | 6:22107 | Washington State Energy Office, Olympia, WA |
| **WAPD-TM-** | | |
| 1385 | 6:22041 | NTIS, PC A09/MF A01 |
| 1386 | 6:22042 | NTIS, PC A05/MF A01 |

## Abbreviations Used in Availability Column

**Dep.** DOE reports so designated are maintained in the organizations listed on the inside back cover.

**EM** Inquiries regarding the availability of blueline prints of DOE engineering drawings which were formerly available for sale by NTIS should be addressed to Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

**ETEC** Available *only to requesters within the United States* from the Energy Technology Engineering Center, P. O. Box 1449, Canoga Park, California 91304.

**GJO** Available from DOE Grand Junction Office, P. O. Box 2567, Grand Junction, Colorado 81501.

**GPO** For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

**NSO** Available *only to requesters within the United States* from the Nuclear Standards Office, Oak Ridge National Laboratory, P. O. Box X, Oak Ridge, Tennessee 37830.

**NTIS** For sale by the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161. Price given is the domestic price for paper copy; prices for foreign purchasers are in most instances twice the domestic price.

**TIC** Available from the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

## NTIS NORTH AMERICAN PRICE CODES

Most NTIS products and services are now announced by price codes and, therefore, without specific prices in NTIS journals, newsletters and indexes.

The current dollar equivalent for each code is shown in the schedule below. Orders must list the accession number(s) and be accompanied by the total dollar amount from the current schedule.

### NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, U.S., and Mexico please use this price schedule; other addressees write for Folder PR-360-4.

| | | |
|---|---|---|
| A01.....$3.50 | E01.....$5.50 | T01..... $110.00 |
| A02..... 5.00 | E02..... 6.50 | T02..... 125.00 |
| A03..... 6.50 | E03..... 8.50 | T03..... 210.00 |
| A04..... 8.00 | E04.....10.50 | T04..... 300.00 |
| A05..... 9.50 | E05.....12.50 | T05..... 360.00 |
| A06.....11.00 | E06.....14.50 | T06..... 420.00 |
| A07.....12.50 | E07.....16.50 | T07..... 480.00 |
| A08.....14.00 | E08.....18.50 | T08..... 540.00 |
| A09.....15.50 | E09.....20.50 | T09..... 600.00 |
| A10.....17.00 | E10.....22.50 | T10..... 660.00 |
| A11.....18.50 | E11.....24.50 | T11..... 720.00 |
| A12.....20.00 | E12.....27.50 | T12..... 780.00 |
| A13.....21.50 | E13.....30.50 | T13..... 840.00 |
| A14.....23.00 | E14.....33.50 | T14..... 900.00 |
| A15.....24.50 | E15.....36.50 | T15..... 960.00 |
| A16.....26.00 | E16.....39.50 | T16.....1,020.00 |
| A17.....27.50 | E17.....42.50 | T17.....1,080.00 |
| A18.....29.00 | E18.....45.50 | T18.....1,140.00 |
| A19.....30.50 | E19.....50.50 | T19.....1,200.00 |
| A20.....32.00 | E20.....60.50 | T99..... * |
| A21.....33.50 | E99..... * | |
| A22.....35.00 | N01.....30.00 | |
| A23.....36.50 | N02.....50.00 | |
| A24.....38.00 | | |
| A25.....39.50 | *Contact NTIS for price quote | |
| A99..... * | | |

PRICES EFFECTIVE JANUARY 1, 1981

**U.S. DEPARTMENT OF COMMERCE**
**National Technical Information Service**
5285 Port Royal Road
Springfield, Virginia 22161

☆U.S. GOVERNMENT PRINTING OFFICE: 1981— 74-143:9

Cut out appropriate form and mail in a stamped envelope to the address indicated.

*Change of Address Form*

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

**PLEASE PRINT OR TYPE**

(or) COUNTRY

Mail this form to:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Attach last subscription label here.

*Subscription Order Form*

**SUBSCRIPTION ORDER FORM**

**ENTER MY SUBSCRIPTION TO:**

**@ $ Domestic; @ $ Foreign.**

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

**PLEASE PRINT OR TYPE**

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No. .....

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

# REPORT COLLECTIONS

The libraries listed below purchase and maintain microfiche collections of DOE and foreign reports. Most of these libraries have microfiche reader-printers or other photocopy facilities with which to reproduce enlarged copies from microfiche. Charges for reproduction services vary.

## United States

**ALABAMA**
Auburn, Auburn University

**ARIZONA**
Tucson, University of Arizona

**CALIFORNIA**
Davis, University of California
Los Angeles, University of California
Santa Barbara, University of California

**COLORADO**
Boulder, University of Colorado

**DISTRICT OF COLUMBIA**
Washington, Library of Congress

**FLORIDA**
Gainesville, University of Florida

**GEORGIA**
Atlanta, Georgia Institute of Technology

**HAWAII**
Honolulu, University of Hawaii

**IDAHO**
Pocatello, Idaho State University

**ILLINOIS**
Urbana, University of Illinois

**INDIANA**
Lafayette, Purdue University

**IOWA**
Ames, Iowa State University

**KANSAS**
Manhattan, Kansas State University

**KENTUCKY**
Lexington, University of Kentucky

**MARYLAND**
Baltimore, Johns Hopkins University
College Park, University of Maryland

**MASSACHUSETTS**
Cambridge, Massachusetts Institute of Technology
Worcester, Worcester Polytechnic Institute

**MICHIGAN**
Ann Arbor, University of Michigan

**MISSISSIPPI**
Mississippi State, Mississippi State University

**MISSOURI**
Columbia, University of Missouri
Kansas City, Linda Hall Library

**NEW JERSEY**
Princeton, Princeton University

**NEW MEXICO**
Albuquerque, University of New Mexico

**NEW YORK**
Albany, New York State Library
Albany, State University at Albany
Ithaca, Cornell University
New York, Columbia University
Rochester, University of Rochester
Syracuse, Syracuse University

**NORTH CAROLINA**
Raleigh, North Carolina State University

**OHIO**
Cincinnati, University of Cincinnati
Cleveland, Cleveland Public Library
Toledo, University of Toledo

**OKLAHOMA**
Norman, University of Oklahoma

**PENNSYLVANIA**
Pittsburgh, Carnegie Library

**PUERTO RICO**
San Juan, University of Puerto Rico

**SOUTH CAROLINA**
Columbia, University of South Carolina

**TEXAS**
Austin, University of Texas
College Station, Texas A & M University
Houston, Rice University

**UTAH**
Salt Lake City, University of Utah

**VIRGINIA**
Charlottesville, University of Virginia

**WASHINGTON**
Pullman, Washington State University
Seattle, University of Washington

**WEST VIRGINIA**
Morgantown, West Virginia University

**WISCONSIN**
Madison, University of Wisconsin

## International

**EUROPEAN ATOMIC ENERGY COMMUNITY (EURATOM)**
Brussels, Belgium
Ispra, Varese, Italy, Cetis Library

**INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)**
Vienna, Austria

**OECD NUCLEAR ENERGY AGENCY (NEA)**
British Library Lending Division
Boston Spa, Wetherby, Yorkshire, England

# AVAILABILITY OF PUBLICATIONS ABSTRACTED

DOE reports are offered for sale by National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161. The availability of other reports, when known, is also indicated in the report number indexes. The availability of some unnumbered reports is given at the point of the citation.

For information on non-report documents such as journal articles, conference papers, books, and monographs the user should contact local, state, and university libraries or commercial reprint services.

Corporate Index
Author Index
Subject Index
Contract Number Index
Report Number Index

UNITED STATES DEPARTMENT OF ENERGY
P.O. BOX 62
OAK RIDGE, TENNESSEE 37830

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
UNITED STATES
DEPARTMENT OF ENERGY

FS- 1
UNIVERSITY MICROFILMS INTERNATIONAL
ATTN SERIALS PROCESSING
300 NORTH ZEEB ROAD
ANN ARBOR, MI 48106